ENGINEERING AND MINING JOURNAL

A McGRAW HILL PUBLICATION

SEPTEMBER 1951

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FOUNDED 1866

Cooling Off a Hot Mine at

250,000 Btu per Minute...

p. 72

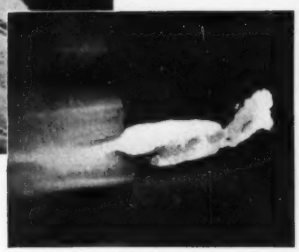
Special:

CIO-MMSW Struggle

May Bring Industry-Wide Bargaining . . . **See p. 101**

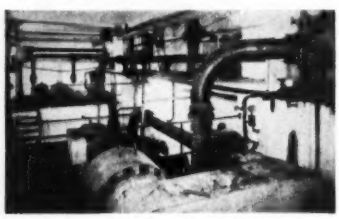
"HYDROSEAL Pumps åro de bästa!" (are the best!)

Slag and water discharging into fill area at Bolidens Gruvaktiebolag, Skelleftehamn, Sweden.



Molten slag entering water in granulating chamber. Viewed from above.

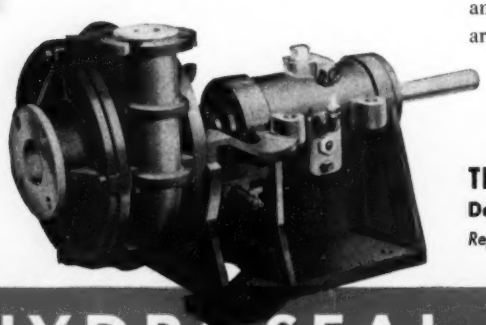
That's what the engineers say at this important Swedish copper smelter near the Arctic Circle. As you'd expect, it gets mighty cold up there, but the Hydroseals keep on running, right through weeks and weeks of steady sub-zero temperatures. Not only do they meet the severest tests of weather, but they more than satisfy the proverbially high standards of Swedish efficiency.



Two C-Frame Hydroseals in series in pump room; also shown are two spares.

In the operation at Skelleftehamn, two Hydroseals in series pump a 180°F mixture of slag and water against a total head of 152 feet. During a normal day, approximately 400 tons of granulated slag are delivered to the fill area at a rate of 2000 G.P.M.

In Swedish or in Afrikaans, from the Arctic Circle to South Africa, when a mill engineer says "Hydroseal" he means the toughest and most efficient solids-handling pump around today.



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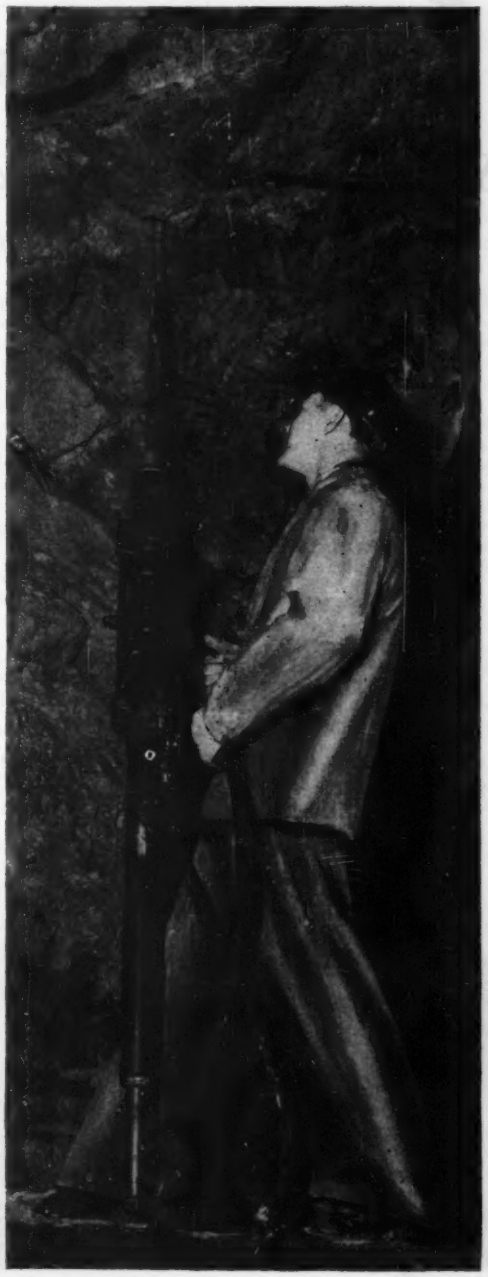
USES 25% LESS AIR

•

DESIGNED TO TAKE FULL ADVANTAGE OF FASTER DRILLING **CARSET JACKBITS**



The lightweight 75 pound Ingersoll-Rand R-38 is easier to carry and easier to set up. Take it anywhere in raises and tough inclined stopes or into far corners of the mine where air pressure may be low and this rugged, fast drilling machine will make light work of your tough stoping jobs.

Because it is designed for use with faster drilling Carset Jackbits and weighs 26% less, this light-weight, easy-handling, machine usually drills equal or better footage than heavier drills in raises or difficult stopes. An additional advantage is a saving of 25% in air consumption.

The R-38 has the same balanced design, strong automatic rotation, self-cleaning chuck and graduated throttle as heavy weight stopehamers—yet is light in weight and easier to handle than makeshift combinations. This same light-weight drill is also available in a short-leg design (RP-38) for roof-bolting work. Your nearest I-R representative will be glad to tell you all about it.

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Save 3 ways! Investigate today! Write or mail coupon

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Patented grommet belts by B. F. Goodrich represent the only basic change since invention of the V belt. Belts last 20 to 50 per cent longer, depending on service. (The more severe the service, the greater the increase over ordinary belts.) Grommet belts have more rubber; they're more flexible, give better grip, less slip.

What is a grommet?

A grommet is like a giant cable except that it's *endless*—a cord loop built up by winding heavy cord on itself. There is no overlapping cord *section* as in all ordinary belts. Most belt failures occur in these sections where cords overlap!

All cords put to work

Each of the two grommets and every part of a grommet carry their share of the load. In ordinary belts under high tension the center cords "dish" because tension is greater near the driving faces. Dished cords are doing less work, not pulling their share. Grommet belts have no center cords, there is no dishing—therefore much more strength in proportion to cord volume—and less stretch. Grommet belts stretch, on an average, only about one-third as much as ordinary belts.

Better grip, less slip

Grommet belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip, there is also less surface wear.

Send for proof

Send the coupon for a set of reports telling users' experiences and showing actual installations where grommet belts outlasted all others. Some typical cases:

"... within a few days ordinary belts had stretched ... After six months of 24-hour-a-day service BFG grommet belts haven't stretched at all ..."

"Ordinary belts lasted only 5 or 6 weeks ... B. F. Goodrich grommet belts are in their sixth month of service ..."

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They cost no more

BFG grommet belts cost not one cent more than others. The savings they make for you are clear profit. They are made in C, D and E sections. They are patented by B. F. Goodrich. No other V belt is a grommet belt (U. S. Patent No. 2,233,294).

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ENGINEERING AND MINING JOURNAL

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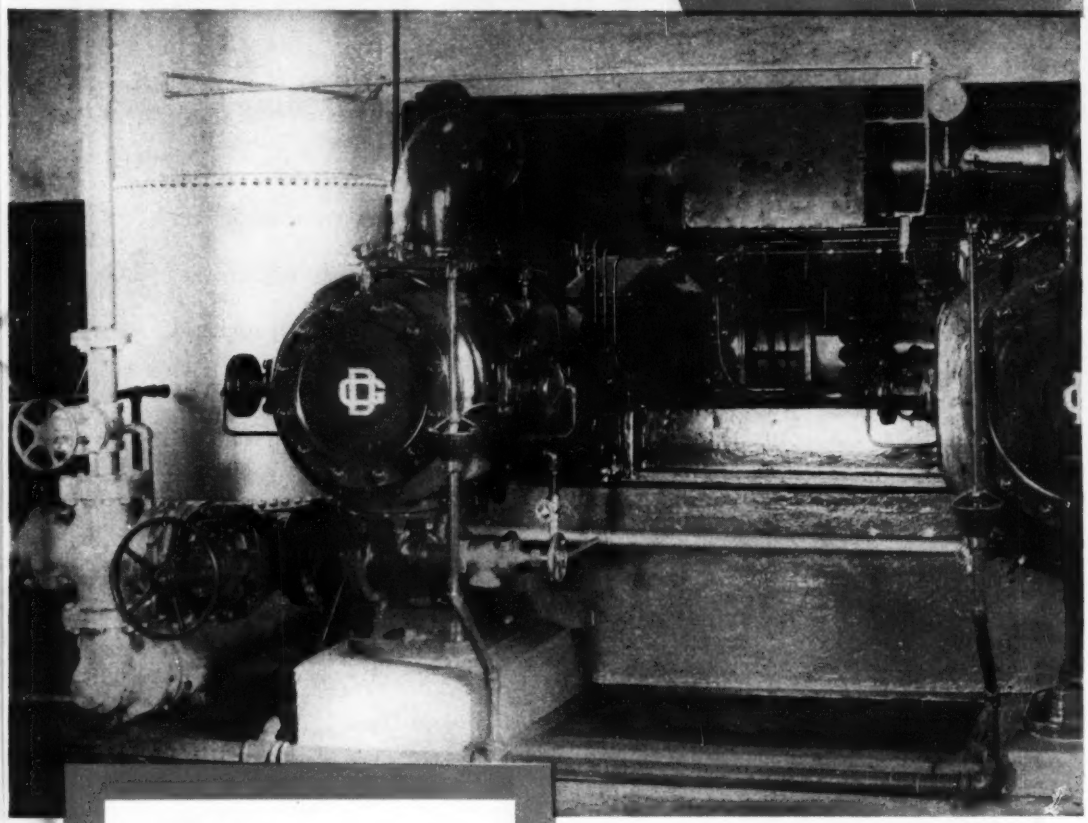

DRILLS of all types run better with *Texaco Rock Drill Lubricant EP*. One user states: "We are amazed at the performance of this oil in comparison with what we had been using. We have cut oil consumption 50% and have shown a remarkable reduction in maintenance on all our drills."

What's the best air compressor oil to keep your compressors working and your maintenance costs low? That depends on your operating conditions. But it *must* be an oil especially designed to meet those conditions. Texaco has it. For example—

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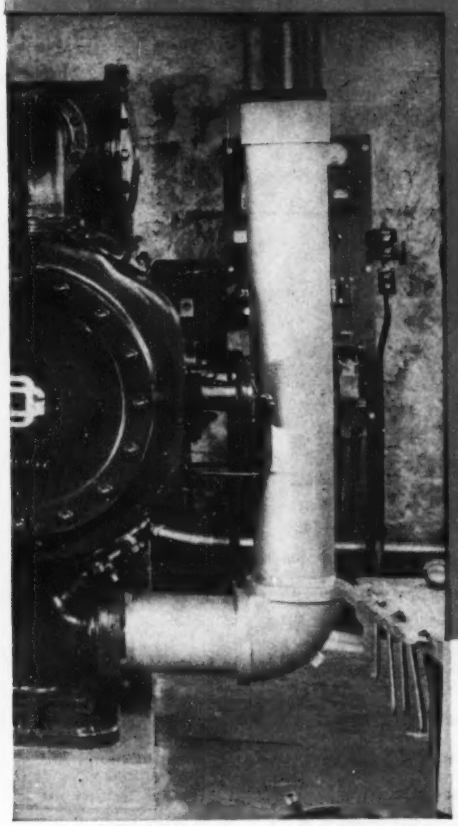

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A Texaco Lubrication Engineer will gladly help you select the one proper Texaco air compressor oil to assure you greater efficiency and lower costs under your particular operating conditions. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

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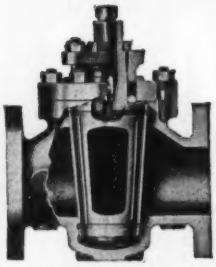

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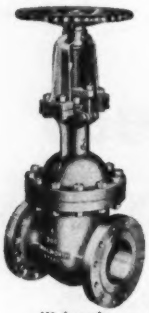
Lubricated Plug Valve



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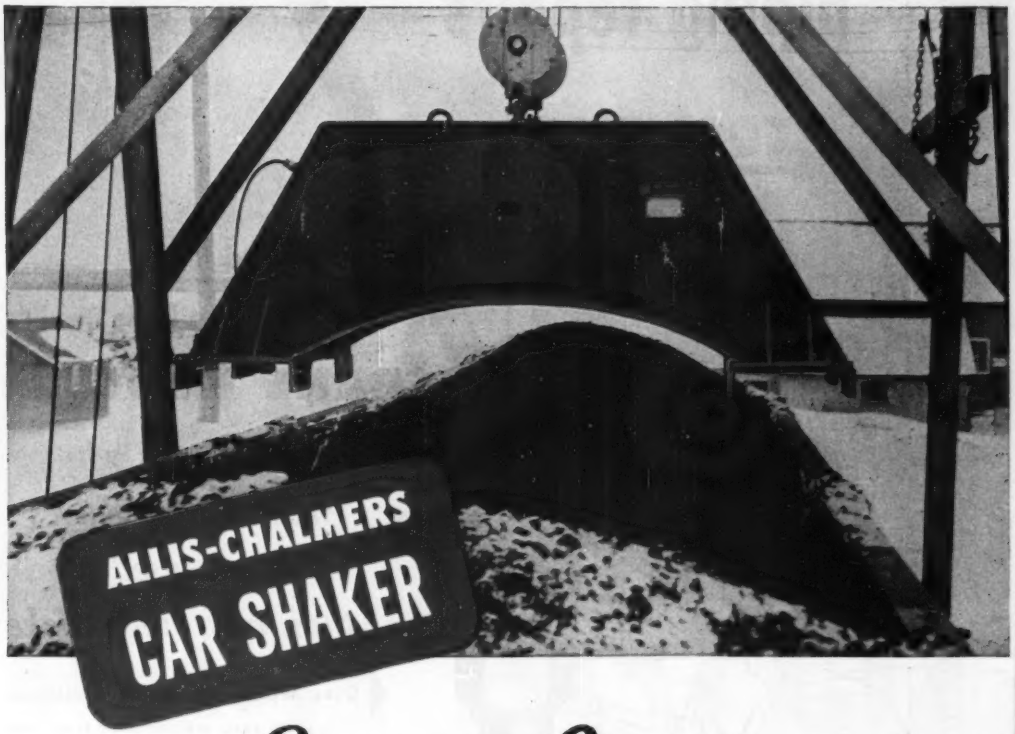

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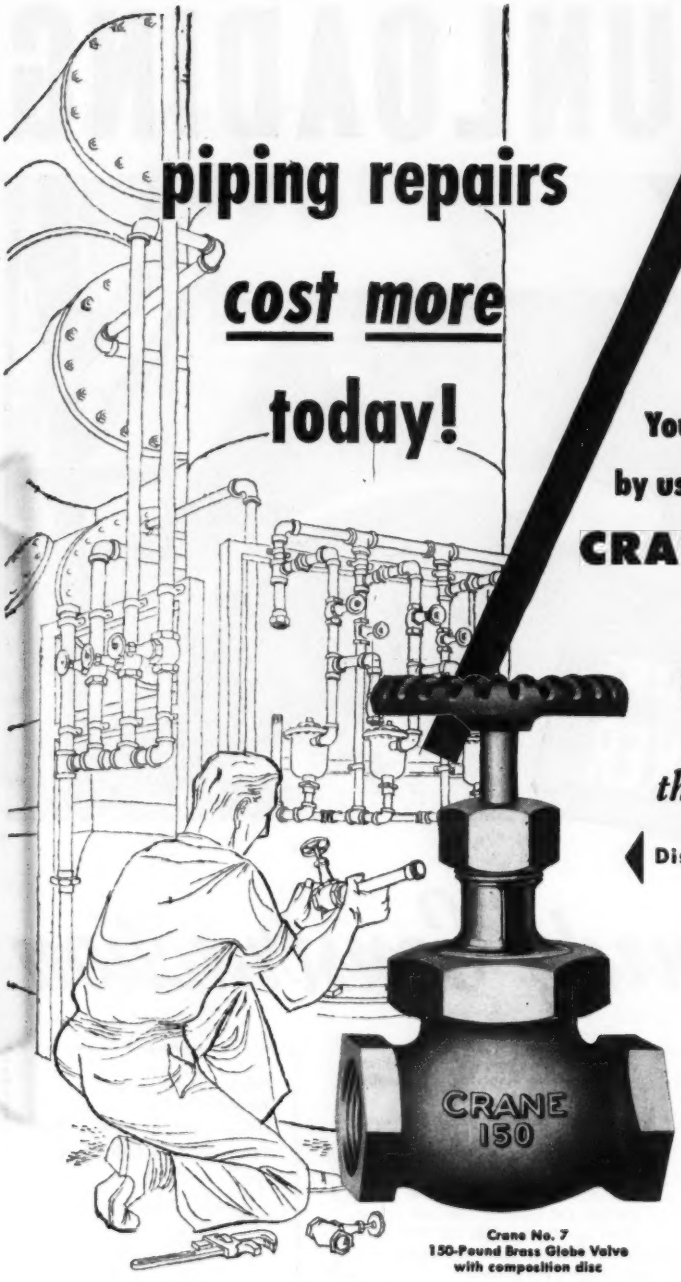

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Bring on your heaviest going! The 955-A is ready for it! It's the 2½ yd. companion of the famous P&H 1055 — with all its proved engineering — tough all-welded construction — greater stability — live roller circle — adjustable hook rollers — and many other advancements that assure years of hard service with minimum cost.

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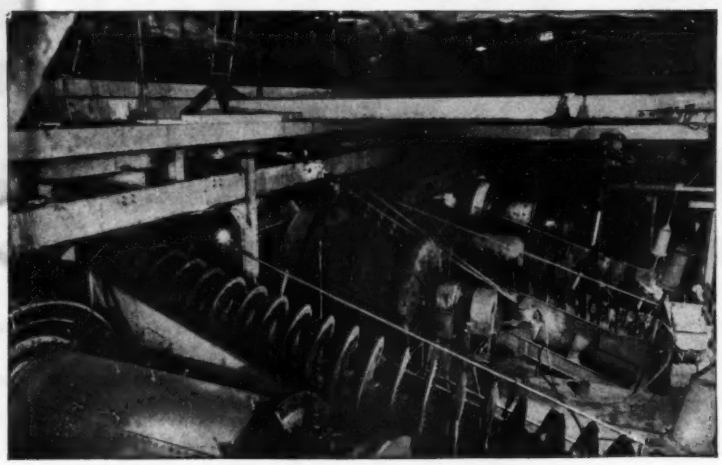
Underground lead-zinc mill hits 1200 tons per day!

1 **Hauling cars of lead-zinc ore** up 15° slope to the underground mill is this 72" drum hoist, driven by G-E 300-hp 440-volt motor and control. Only one of its kind, the Gilman lead and zinc mill was built entirely underground because in the mountainous terrain surrounding it there is not enough level country. Several hundred feet down, in rooms cut out of hard rock, crude ores from the adjacent mine are concentrated for smelting at distant plants.

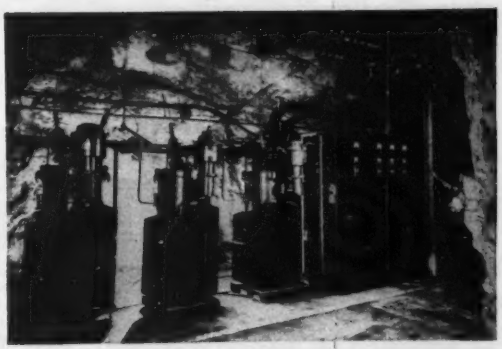


2 **In the underground grinding room,** two 100-hp and two 75-hp 440-volt G-E motors and control drive grinding mills. Classifier drives consist of four 10-hp G-E motors and control. Naturally heated to 83F, water for grinding process is pumped from mine to mill by G-E induction motors.

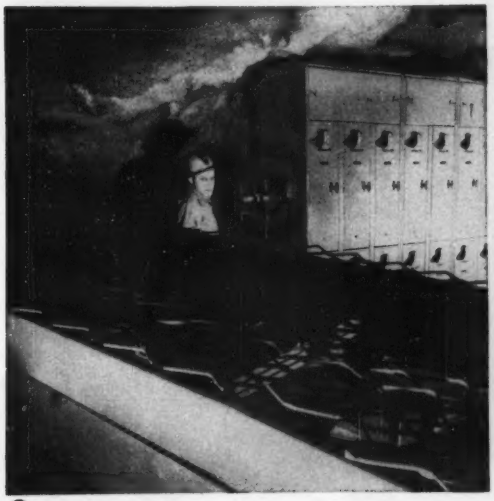
GENERAL ELECTRIC

660-23

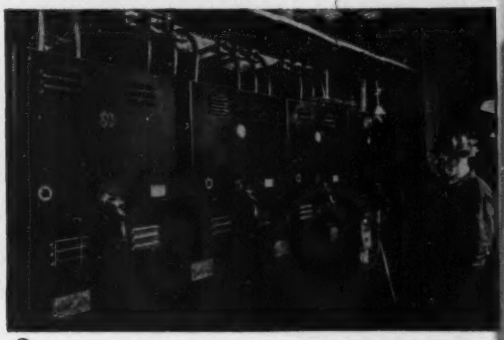
Co-ordinated G-E drives and distribution equipment help maintain continuity of production at New Jersey Zinc's unique Gilman, Colo. concentrating plant



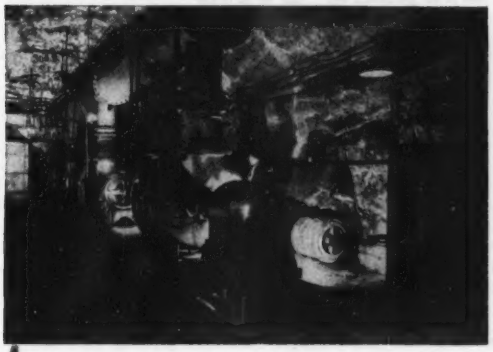
5 **Power for the mine** comes down from the surface at 13,800 volts through 4500 feet of G-E armored cable. At this substation—comprising a G-E switchboard and three 150-kva Pyranol† transformers with gas absorbers—it is stepped down to 440 volts for utilization throughout the mine's two lowest levels.



3 **Grouped motor control** is provided at several points throughout the mill by compact G-E Cabinetrol* units. Space-saving Cabinetrol "packages" include all controls and instruments needed for various milling processes. This neat assembly, together with its associated push-button stations, is located in the mill's flotation cell room.



6 **To protect equipment** against damage from excessive overcurrents caused by heavy overloads or short circuits, the mill uses four G-E 3-pole air circuit breakers rated 600 amperes, 600 volts. G-E air-circuit breakers, selected for adequate interrupting capacity, help safeguard against loss of production in all milling operations.



4 **After grinding the ore,** lead minerals are separated from zinc minerals and waste, and then zinc minerals are separated from waste tailings in flotation cells. Air for flotation cells is supplied by these blowers, driven by three 125-hp 440-volt G-E a-c motors, with G-E control at right.

*Reg. trade mark of General Electric Co. for enclosed control panel equipment.

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for the Mining Industry

At every stage in ore processing—mining, concentrating, smelting, or refining—a G-E mining industry specialist can help you solve your electrical problems efficiently, economically. He's a good man to know. Call him soon! *General Electric Company, Schenectady 5, N. Y.*

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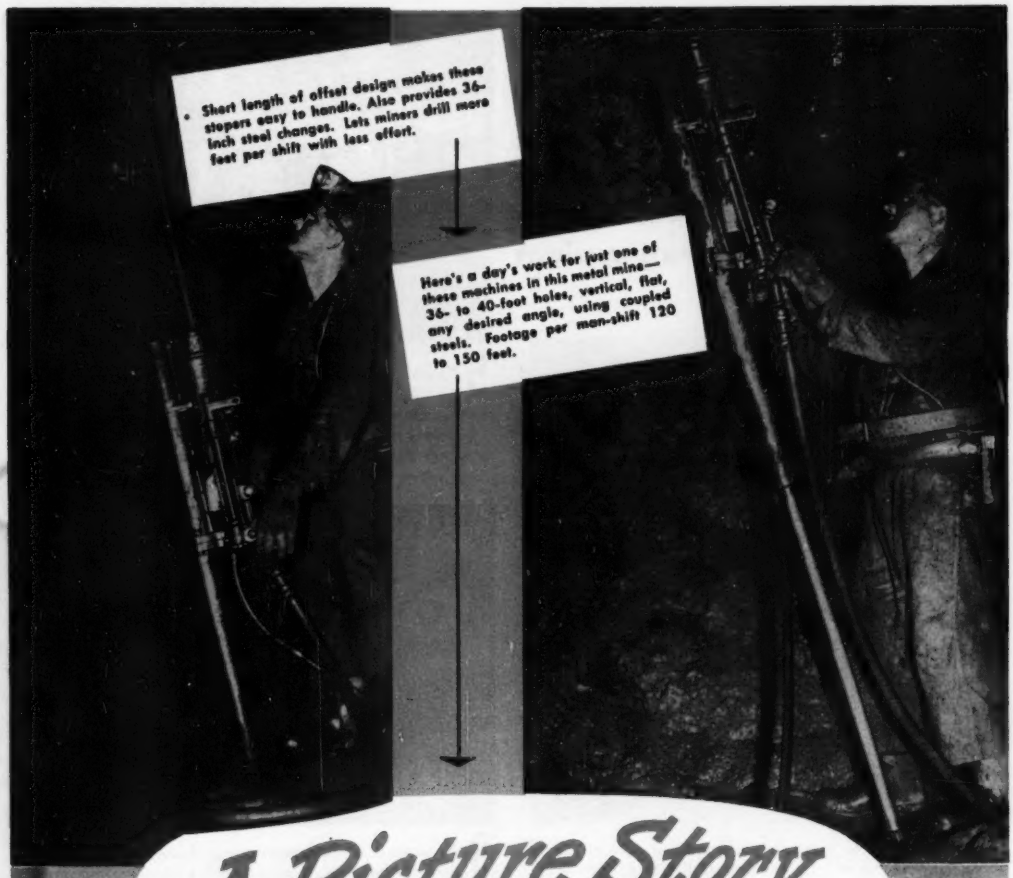
Short length of offset design makes these stopers easy to handle. Also provides 36-inch steel changes. Lets miners drill more feet per shift with less effort.
Here's a day's work for just one of these machines in this metal mine—36- to 40-foot holes, vertical, flat, any desired angle, using coupled steels. Footage per man-shift 120 to 150 feet.

A Picture Story of Lower Stoping Costs

. . . shows how Le Roi-CLEVELAND offset stopers drill extra footage, save you money

Take a good look at these pictures. Note the length of the drill steel. Fitted with carbide-tipped bits, it gives you 36" of drilling—3 feet with every change.

That's one of the reasons why Le Roi-CLEVELAND offset stopers are paying off in lower drilling costs.

But it's not the whole story. The machines shown here are equipped with downstroke rotation. This gives plenty of power and lets the miners drill holes from 36 to 40 feet in depth — using coupled steel. Total footage drilled per man-shift runs from 120 to 150 feet.

Performance like this does a lot to keep costs down. It also accounts for the growing popularity of Le Roi-CLEVELAND offset stopers wherever stoping is a problem.

Other features of these machines are: Removable water tube — no need to dismantle the machine. Graduated feeding pressure. Constant blowing at chuck keeps machine clean. Write us today for complete details.

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in any form!

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Northwest brings you the advantages that make a real Rock Shovel. The Northwest Dual Independent Crowd gives more output in tougher digging because it utilizes force most other independent crowd shovels waste. The "Feather-Touch" Clutch Control gives ease of handling with simplicity of design. Positive traction while turning, as well as when going straight ahead, assures better mobility on benches and over rough floors. Add to these, the Cushion Clutch, Uniform Pressure Swing Clutches, easier upkeep and the established fact that whether operating as a Shovel, Crane, or Dragline the better balance of related parts assures smoother performance for a better day's work.

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that Pioneer Edge

How Wacootah Mine was kept in operation

With the supply of choice ore exhausted at its Wacootah Mine, Wheeling Steel Corporation was faced with the alternative of abandoning the operation or finding efficient means for handling and concentrating low grade ore. The crushing, screening and washing plant shown here provided the solution.

Delivered by truck, the material is ingeniously routed by sturdy Pioneer feeders and conveyors thru a Pioneer scalping screen, jaw crusher, washing screen, and classifier. The result is a high grade concentrate, economically produced and ready for market.

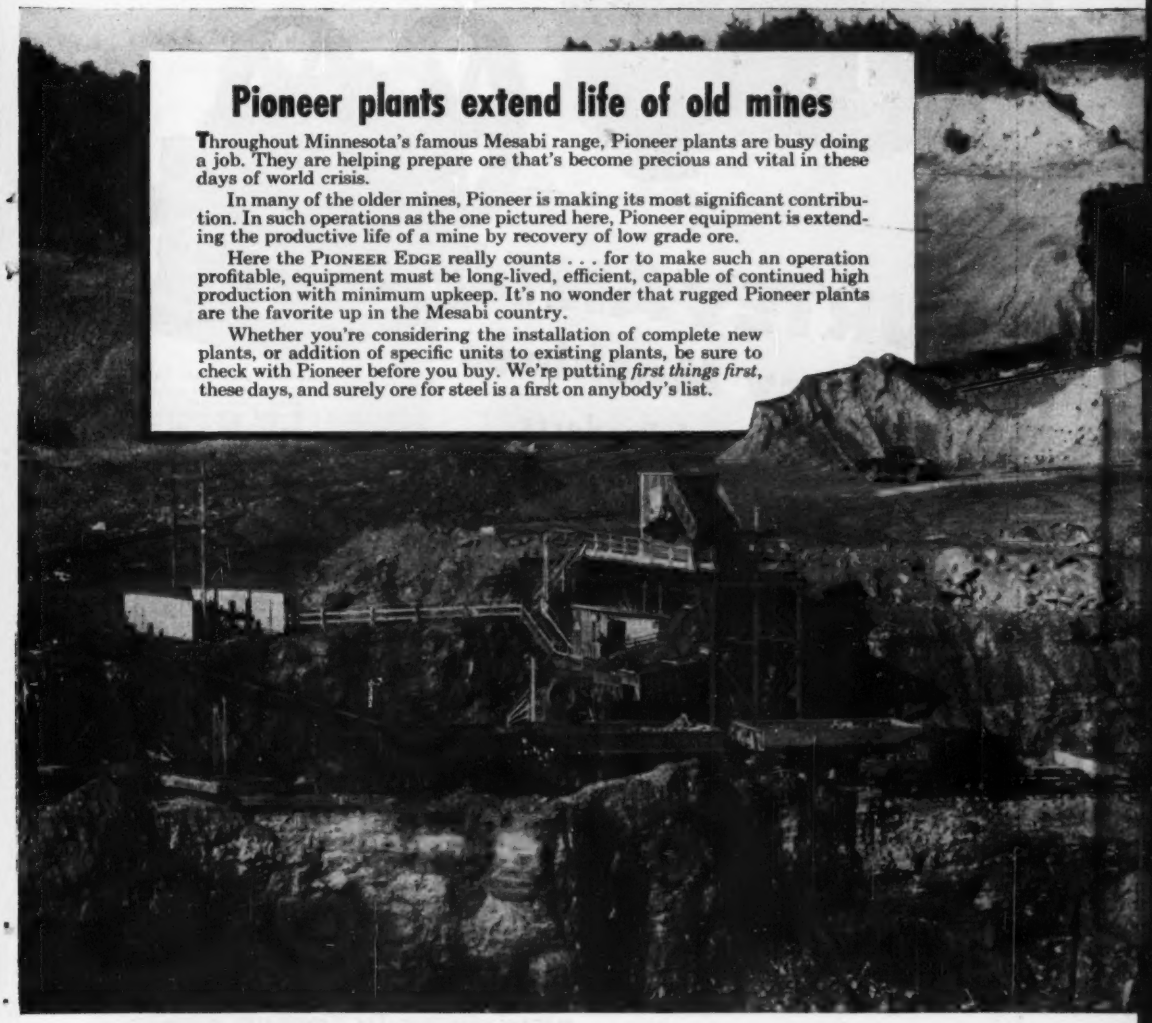
This plant, near Mountain Iron, Minnesota, consistently exceeds its rated capacity of 100 tons per hour. It is but one of the many successful Pioneer installations operating on the Mesabi and Cayuna Ranges.

BUY BOTH!
HIGHER OUTPUT
LOWER UPKEEP

Pioneer

Continuflo EQUIPMENT

keeps iron ore flowing



Pioneer plants extend life of old mines

Throughout Minnesota's famous Mesabi range, Pioneer plants are busy doing a job. They are helping prepare ore that's become precious and vital in these days of world crisis.

In many of the older mines, Pioneer is making its most significant contribution. In such operations as the one pictured here, Pioneer equipment is extending the productive life of a mine by recovery of low grade ore.

Here the PIONEER EDGE really counts . . . for to make such an operation profitable, equipment must be long-lived, efficient, capable of continued high production with minimum upkeep. It's no wonder that rugged Pioneer plants are the favorite up in the Mesabi country.

Whether you're considering the installation of complete new plants, or addition of specific units to existing plants, be sure to check with Pioneer before you buy. We're putting *first things first*, these days, and surely ore for steel is a first on anybody's list.

***These units give* WHEELING STEEL *that* Pioneer Edge AT WACOOTAH**

- 48" x 12'3" Manganese Steel Feeder
- 4' x 10' Mesabi Scalping Screen
- 36" x 14' Rock Reject Apron Feeder
- 30" x 12' Apron Feeder Under Scalping Screen
- 30" x 42" Jaw Crusher
- 5' x 12' Mesabi Double Deck Washing Screen
- 24" x 105' Super Service Conveyor
- 24" x 130' Super Service Conveyor

In addition, there are a 1000 G.P.M. Tailings Pump, a 36" x 19'3" Classifier and a 90 tons capacity track loading pocket.

PIONEER ENGINEERING WORKS
1515 Central Avenue • Minneapolis 13, Minnesota
Subsidiary of Poor & Company, Chicago

● Please send me information on the equipment checked.

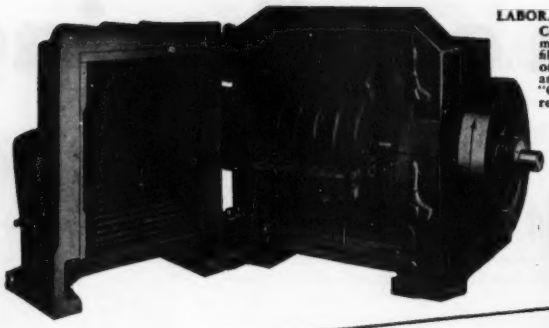
- ☐ MANGANESE STEEL FEEDERS
- ☐ FORGED STEEL APRON FEEDERS
- ☐ JAW CRUSHERS
- ☐ ROLL CRUSHERS
- ☐ VIBRATING SCREENS
- ☐ LONG CONVEYORS
- ☐ PORTABLE CONVEYORS
- ☐ ORE WASHING PLANTS
- ☐ SEND ME COMPLETE DETAILS OF OPERATION OF THE PLANT FEATURED IN THIS ADVERTISEMENT.

*Name*_____

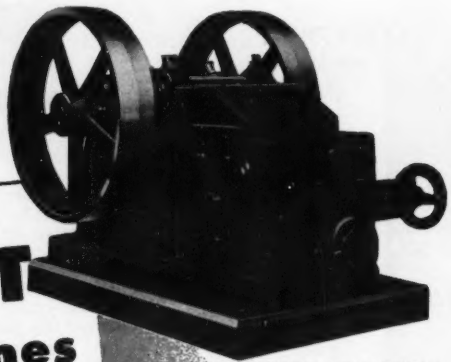
*Company*_____

*Address*_____

*City*_____ *Zone*____ *State*_____

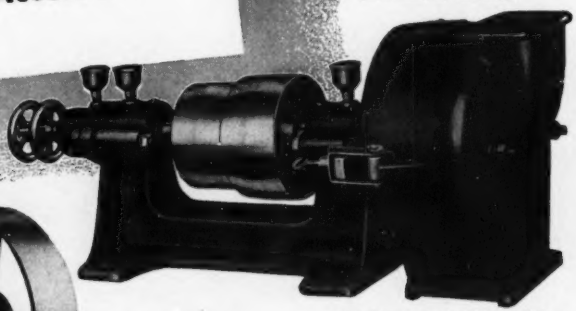


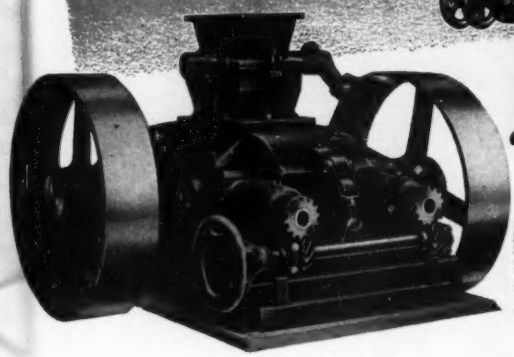
LABORATORY SWING-SLEDGE MILLS
Capable of reducing soft, moderately hard and tough or fibrous materials to any degree of fineness between 1 in. and 20 mesh. The patented "Open-Door" feature permits ready accessibility for cleaning.



STURTEVANT
Laboratory Machines
Assure Quality of Products
Fast - Economical - Accurate

LABORATORY JAW CRUSHERS
Special Roll Jaw action simplifies close regulation of the product with capacities varying from 300 or 400 lbs. per hour at finest settings, to 1000 or 2000 lbs. when opened for coarser work. Each part of the crusher is accessible for quick and easy cleaning.





LABORATORY CRUSHING ROLLS
First designed especially for laboratory sampling work, Sturtevant Crushing Rolls are used regularly in many plants where there are limited outputs. Range of output for the 8 x 5 size is from ½ in. to 20 mesh — and for the 12 x 12 size from ¾ in. to 20 mesh.

LABORATORY SAMPLE GRINDER
Laboratory Sample Grinders are of the "Open-Door" disc type and are capable of very fine work, producing products as fine as 100 mesh (coarser if desired) when working on dry, friable, soft or moderately hard materials. Simply turn hand wheel to provide product regulation from 10 to 100 mesh.

The only sure way to maintain strict quality of products is laboratory control . . . and that calls for accurate sampling.

Sturtevant Laboratory Equipment meets the exacting requirements of laboratory work. They are fast and accurate . . . provide true samples.

Rugged and dependable, Sturtevant equipment actually has all the features of full size machines plus extra accuracy and wider range of adjustment. The "Open-Door" accessibility permits quick, thorough cleaning . . . prevents the possibility of previous batches from contaminating new samples.

Investigate Sturtevant equipment for your laboratory. It will cut your sampling costs . . . help maintain strict quality of products . . . increase sales. Write for complete details and catalog.

STURTEVANT MILL COMPANY
101 CLAYTON STREET, BOSTON 22, MASS.

Designers and Manufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS • MECHANICAL DRYERS and EXCAVATORS • ELEVATORS •

EXTRA TOUGH CARCASS
for extra strength and dependability

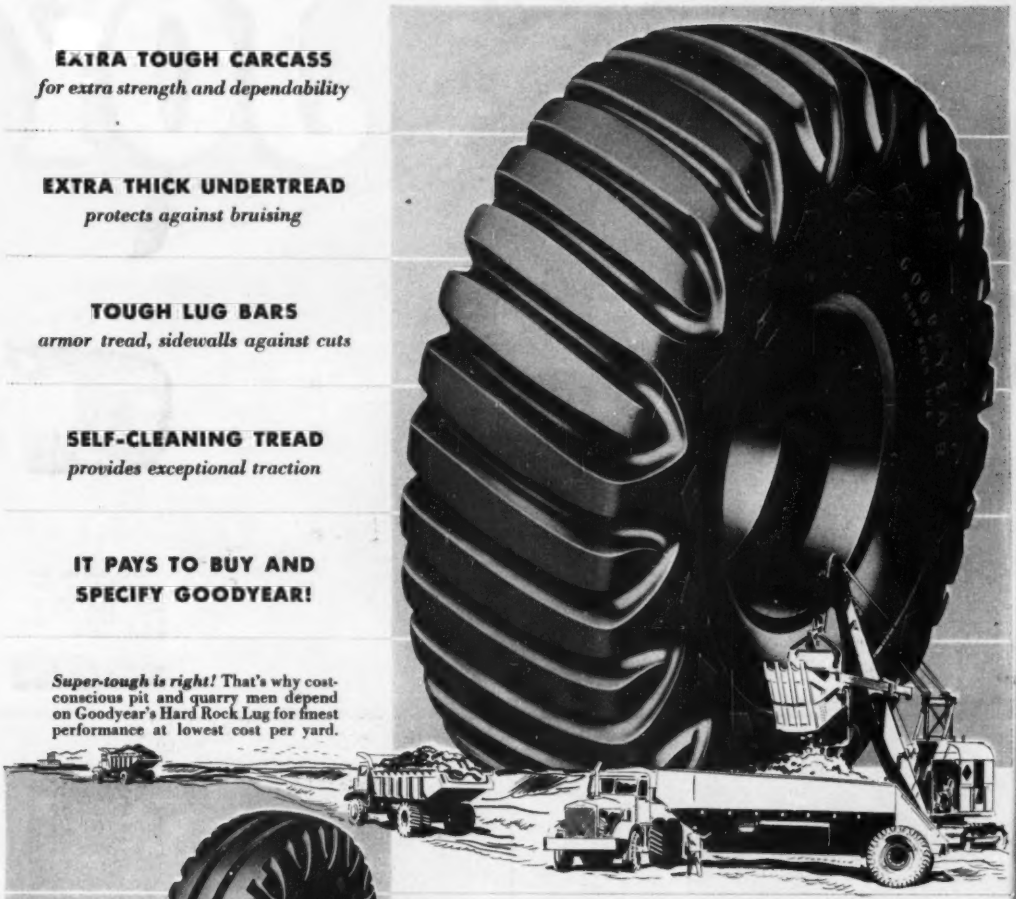
EXTRA THICK UNDERTREAD
protects against bruising

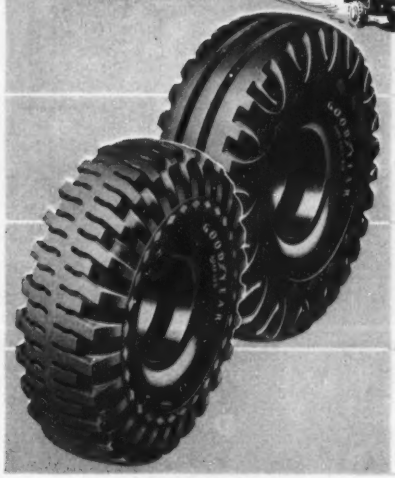
TOUGH LUG BARS
armor tread, sidewalls against cuts

SELF-CLEANING TREAD
provides exceptional traction

IT PAYS TO BUY AND SPECIFY GOODYEAR!

Super-tough is right! That's why cost-conscious pit and quarry men depend on Goodyear's Hard Rock Lug for finest performance at lowest cost per yard.





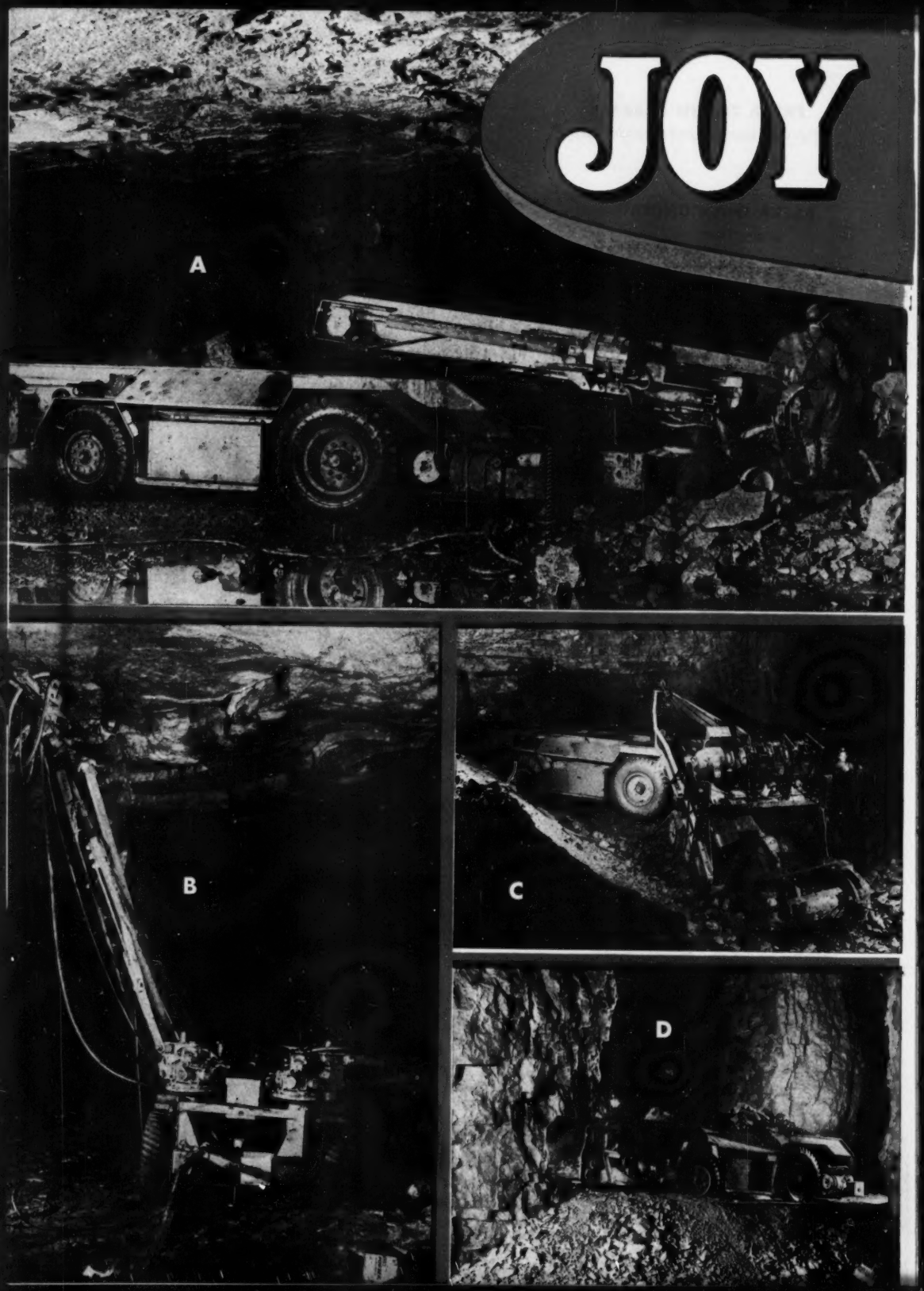
That's why **MORE TONS ARE HAULED ON GOODYEAR TIRES THAN ON ANY OTHER KIND!**

HARD ROCK RIB
Companion tire for front wheels in rock work—easier steering, smooth rolling, same cord body, same shoulder and sidewall as Hard Rock Lug.

ROAD LUG
Remarkable dual purpose tire operates both OFF and ON the road. Combines off-the-road toughness and traction with on-the-road mileage and economy.

GOODYEAR

Head Line—T.M. The Goodyear Tire & Rubber Company, Akron, Ohio


JOY
A
B
C
D

MECHANIZED EQUIPMENT

reduces costs—increases tonnage

. . . does the DRILLING, LOADING and HAULING JOBS with TOP EFFICIENCY

JOY DRILLMOBILES

In photograph B on the facing page, the long reach of a JOY Drillmobile is being utilized in taking down back. These rubber-tired, self-propelled, twin-boom units are setting new standards of fast, low-cost drilling in modern trackless mining, both in the metal and non-metallic fields. JOY Drillmobiles are fast-tramming, highly maneuverable machines, available in three sizes for work in any size heading or in stopes where the grade is not too steep. Drills can be equipped with long feed or standard drifter cradles and are mounted on JOY Hydro Drill Jibs, which make hole-positioning easy and accurate, and permit remote control for maximum safety. ● *Write for Bulletin 87-F.*

JOY 18-HR-2 LOADERS

Photograph A at the top of the page at left shows a JOY high capacity, continuous-type Hard Rock Loader in operation, loading into a JOY Shuttle Car in one of the mines of the Southeast Missouri Lead Belt. This heavy-duty, crawler-mounted machine loads up to 12 tons per minute, producing high tonnage at low cost in trackless mining. It is ruggedly built to handle hard and abrasive rock and ores. The JOY gathering mechanism (not shown in the picture) assures top efficiency, and the chain conveyor swings 45° to either side of center to meet various loading requirements. A smaller model, the JOY 17-HR Loader, is built for use in more restricted areas. ● *Write for Bulletin J-108.*

JOY SHUTTLE CARS

The versatility and flexibility of JOY Shuttle Cars in metal and non-metallic trackless mines is well illustrated by the photographs on the opposite page. In photos A and C, JOY Model 60 Shuttle Cars are shown being loaded by a JOY Hard Rock Loader and a scraper, respectively; and in photograph D, a car is shown making fill. JOY Model 60 Shuttle Cars (up to 14 tons capacity) are designed to give you rapid and low-cost transferring of rock and ore from loading points to main haulage systems. They are ruggedly-built, fast-tramming cars, with conveyor bottoms to speed loading and unloading and are available with hydraulic cable reel, trolley or diesel drive to suit operating conditions. ● *Write for Bulletin J-200.*

JOY SLUSHERS

In photograph C on the facing page, a JOY electric motor-operated three-drum Slusher is shown mounted over a scraper ramp, which in turn is mounted on a JOY Drillmobile chassis for easy maneuverability in a Southeast Missouri mine. JOY Slushers are available in a full range of two and three-drum models, including air or electric-powered types, adaptable for automatic or remote control if desired and built for heavy duty with low maintenance. Allied JOY equipment includes a complete line of air, electric or gasoline engine-powered single-drum Hoists, Air Motors and Winches, Carpullers and Ropepullers, Sheave Blocks and Scrapers. ● *Write for Bulletin 76-Y on JOY Slushers and Bulletin 76-X on JOY Hoists.*

Consult a Joy Engineer

W&O M3303

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

Here's how rubber-tired TOURNADOZER speeds pit maintenance

STRIPS SHALE THE YEAR 'ROUND

At Middle Branch, Ohio, Diamond Portland Cement Co., strips shale year 'round with C Tournadozer. "Will move as much shale in ½ day as our crawler can in a full day," says Vice President E. R. Evans. For clean-up at plant, Tournadozer runs 3 miles from plant to pit over asphalt roads in a few minutes.

You get action-fast

Tournadozer works anywhere . . . any time, "runs" on big 21.00 x 25 low-pressure tires at speeds up to 19 m.p.h. Tournadozer works in toughest footings . . . up steep grades . . . in any kind of weather . . . through mud, sand, or snow which would stall ordinary crawlers. At a moment's notice, operator can drive rig anywhere over highway or cross country to distant pushing, pulling or dozing assignments. No delays for trailer, blocking, loading or unloading.

With a standard bulldozer blade or interchangeable Angledozer blade or V-type Snow Plow, plus its ability to tow a Rooter or haul Scrapers, Tournadozer is an all-year tool. It has fast, 4-wheel drive on rubber, instant gear change with constant-mesh transmission, torque converter, powerful 4-wheel, disc-type air brakes with a total of 2822 sq. in. braking area, plus fast, easy fingertip electric control.

Check actual job performance reports shown here. Ask your LeTourneau Distributor for additional output figures and other facts on versatile Tournadozer.

Tournadozer, Tournapull, Carryall, Angledozer, Rooter—Trademark Reg. U. S. Pat. Off. C149-m

LETOURNEAU LET EQUIPMENT

HIGH-SPEED, RUBBER-TIRED EXCAVATING • HAULING • LIFTING EQUIPMENT

GRADES AND MAINTAINS ROADS

At pit north of Arctic Circle at Kirkenes, Norway, over 25 million yds. of rock ore being removed to uncover magnetite ore. Sydvaranger, A/S, Oslo, started hauling with six 40-ton, rear-dump Tournarockers, later added 6 more *plus* 2 C Tournadozers. Dozers build and maintain haul roads and handle shovel clean-up. Combined, the 14 units are moving 12,000 tons of rock and ore per day.

SHOVEL CLEAN-UP

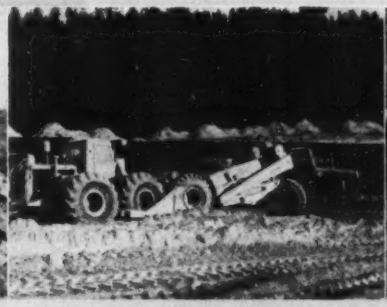
Working at Stanley Mining Company's ore pit at Biwabik, Minn., Tournadozer's principal job is handling clean-up around the ore shovel. On this multi-handling, 24-hr., 7-day a week ore operation, Tournadozer utilizes normal waiting periods to maintain rock dump, clean spillage at crushing plant . . . feed material from surge pile to hopper . . . clear timber ahead of rock drill, etc. Rig has 4 speeds forward, 2 reverse.

DOZES ORE INTO GRIZZLY

On bauxite stripping near Little Rock, Arkansas, 1 Tournadozer handles 5 major jobs every day . . . is on call 24 hours a day. It dozes bauxite ore into 4 to 8 grizzlies . . . maintains quarry rock stockpile . . . cleans up around two 2½-yd. shovels . . . pulls 13-yd. wagon to haul and spread waste material. "It's been doing the work of 2 crawlers," reports the Plant Supt. Operator can change gears without stopping.

MAINTAINS DUMPS

Tournadozer's high-speed and rubber-tired mobility enables it to keep busy day and night for the E. W. Coons Co. at the Genoa strip mine at Eveleth, Minn. During one typical 10-hour *night* shift, the big rig maintained 2 overburden dumps and lean ore stockpile, did clean-up work around 3 stripping shovels, found time to do haul road maintenance besides. No wonder this firm likes their Super C Tournadozer!



PUSH LOADS SCRAPERS

J. Neils Lumber Co., Libby, Montana, teamed this C Tournadozer with 3 C Tournapulls on an 800,000-yd. access road near Rexford. With Tournapulls on 2000' cycles, Tournadozer pushed 42 loads of sand an hour . . . with 'Pulls on 600' cycles, 54 loads hourly. Load distance for 9½ pay yards averaged 75' . . . load time, 30 seconds. With Angledozer blade mounted, rig speeds sidehill work.

PULLS HEAVY EQUIPMENT

Skidding heavy compressor is one of many maintenance jobs Tournadozer handled around Interstate Iron Co. mines near Calumet, Minn. The "C's" big, 186 h.p. diesel engine and 4-wheel drive develop plenty of drawbar pull to handle heavy loads. It pulls Carryall-Scrapers, tows floaters, heavy-duty trailers, bogged down trucks; skids generator plants, cable-boats, poles, piling, etc.

SPOTS RAILROAD CARS

Here, versatile Tournadozer spots empty rail cars under ore loader for Mesabi Iron Range Mining Company. Powerful rig is handy for switching cars . . . keeps sidings clear for incoming freight. Tournadozer takes shortest route between jobs . . . rubber tires permit it to cross or follow tracks anywhere without planking. Instant-shift gear selection keeps unit pushing without losing momentum.

WORKS SCATTERED JOBS

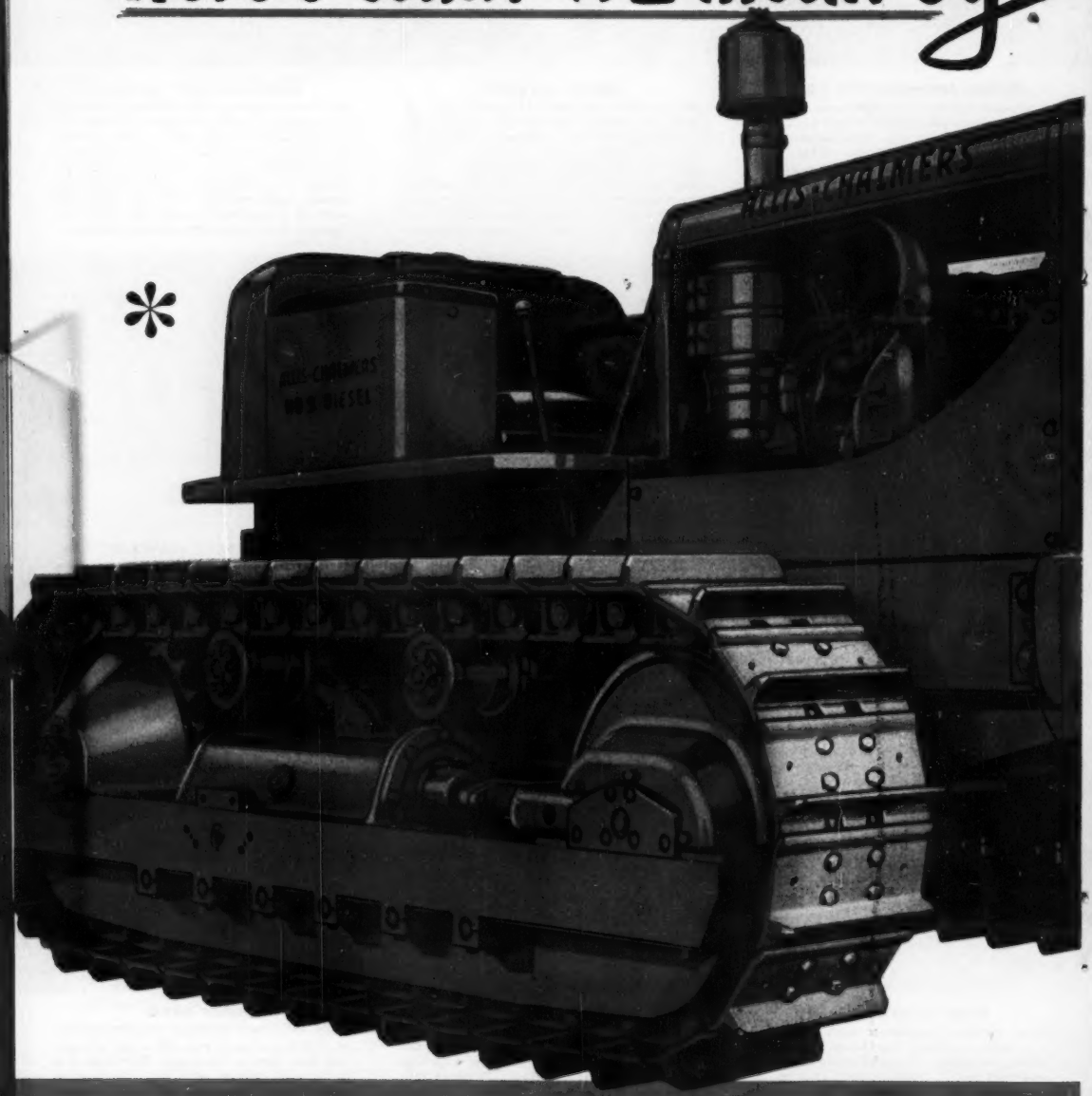
Leveling spoil, clearing snow, and handling pit clean-up for West Virginia-Pittsburgh Coal Co. mine at Collier, W. Va., Tournadozer draw high praise from Owner P. A. Howe. "It dozes 50% more spoil than a crawler," he said, "and is so fast and mobile that we use it to work all 5 of our pits over a 10-mile route. It saves us 1 to 2 tractors." Drives a mile in a few minutes . . . travels over pavement, crosses tracks.

PLOWS SNOW

In 34° below zero weather, a Rural Municipality in Manitoba cleared over 600 miles of roads and farm lanes in 142 hours. Drifts were 3 to 8 ft., some almost solid ice. Tournadozer mounted a LeTourneau 12'3" x 6'6" V-type snow plow. Vertical divider plate in center cuts frozen drifts . . . eliminates plowing snow back on road . . . big tires and adjustable runner shoe protect plowed surface.

R. G. LeTOURNEAU, INC., PEORIA, ILLINOIS

Here's what WE mean by

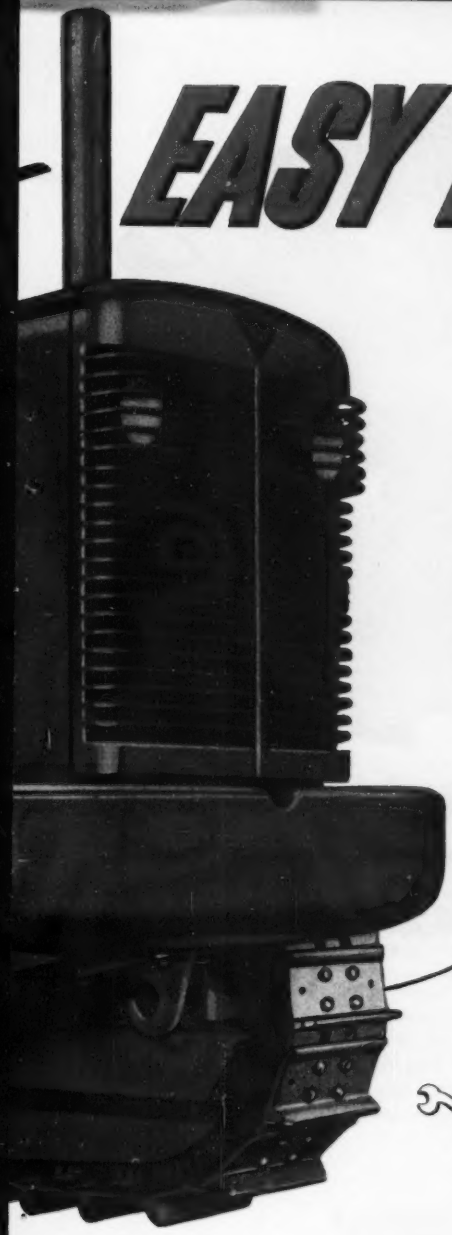


*

	*		
40.26 drawbar hp. 11,250 lb.	70 drawbar hp. 18,800 lb.	102 drawbar hp. 27,850 lb.	Hydraulic Torque Converter Drive 175 net engine hp. 41,000 lb.

• DESIGNED FOR YOUR JOB • BUILT TO TAKE IT • EASY TO OPERATE • EASY TO SERVICE

EASY TO SERVICE



- Allis-Chalmers' new tractor line is blazing the way to simpler servicing with time and money savings never before possible.
- Adjustments are easier . . . lubrication simplified and lube periods greatly extended. Mechanics say these are the easiest tractors they have ever worked on!
- This all adds up to less down time, more producing time . . . longer tractor life at less upkeep cost.
- Below are just a few reasons why this NEWEST, FINEST TRACTOR LINE ON EARTH is *Easy To Service* . . . besides being built to "take it," easy to operate and entirely new in performance. Get the full story from your Allis-Chalmers dealer.

TIME-SAVING LUBRICATION DESIGN—
Only a few lube points, easy to get at — NONE UNDER TRACTORS. You operate 75 HOURS without any greasing — then only one fitting to hit and an oil change to make. (Only exception, torque converter bearings on HD-20). You lubricate the Positive-Seal truck wheels, support rollers and idlers only once every *1,000 HOURS!*

ACCESSIBLE ADJUSTMENTS—*QUICKLY MADE*—
brakes, master clutch, steering clutches. No floor plates to remove for any adjustments. Tracks easier to adjust — simple screw adjustment with automatic lock.

EASY TO REPAIR—
Engine, master clutch, transmission, steering clutches and final drives can be easily removed and repaired or replaced, *without disturbing adjacent assemblies.*

.... The Newest, Finest Tractor Line on Earth!

ALLIS-CHALMERS

TRACTOR DIVISION · MILWAUKEE 1, U. S. A.

Life-Line motor

PAIRED FOR PRODUCTION

Life-Linestarter

ASSURE production schedules with these two

Climbing production curves necessitate squeezing out every possible productive minute from every production machine. There's no time for motor and control "time out". Together or individually, Life-Line motors and starters offer the best assurance of continuous production. They are built to—

STOP outages due to improper bearing lubrication. Life-Line motors, with their prelubricated, sealed-for-life bearings, need no lubrication. Grease guns can be thrown away—motor lubrication schedules forgotten.

STOP outages due to cracked and broken motor frames. Life-Line motor frames stand up to the hard knocks of day-to-day use. They're steel. More protection is afforded with less size and weight. This rigid frame maintains bearing alignment and positive rotor air gap.

STOP outages due to burned and pitted starter contacts. Life-Linestarter's® exclusive "De-ion®" arc quencher quickly extinguishes destructive arcs. The "De-ion" grid snuffs out arcs . . . contacts last longer.

STOP outages due to inadequate overload protection. Life-Linestarter prevents motor burnout due to overloads. The bimetallic, snap-action, disc type of overload relay shoulders the burden. Precise calibration . . . not affected by aging or oxidation.

Other Life-Line features that will aid you in meeting increased production schedules are covered in "Life-Line Book", B-3842 and "Tomorrow's Starter Today", B-4677. Ask your Westinghouse representative for your copies. Or write to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-21642

YOU CAN BE SURE... IF IT'S

Westinghouse

Life-Line

MOTORS and CONTROLS

No body-hoist

GRAVITY DUMP cuts maintenance costs... speeds haul cycles

Koehring Dumptors have no slow-working body hoists. Trip the release lever and gravity dumps the 6-yard load in one second. It's as simple as that! No complicated mechanical hoists to slow up haul cycles . . . no expensive replacement parts, costly hoist maintenance or down time to eat into your profits. And gravity dump is instantaneous and trouble-free in all temperature extremes . . . never wears out.

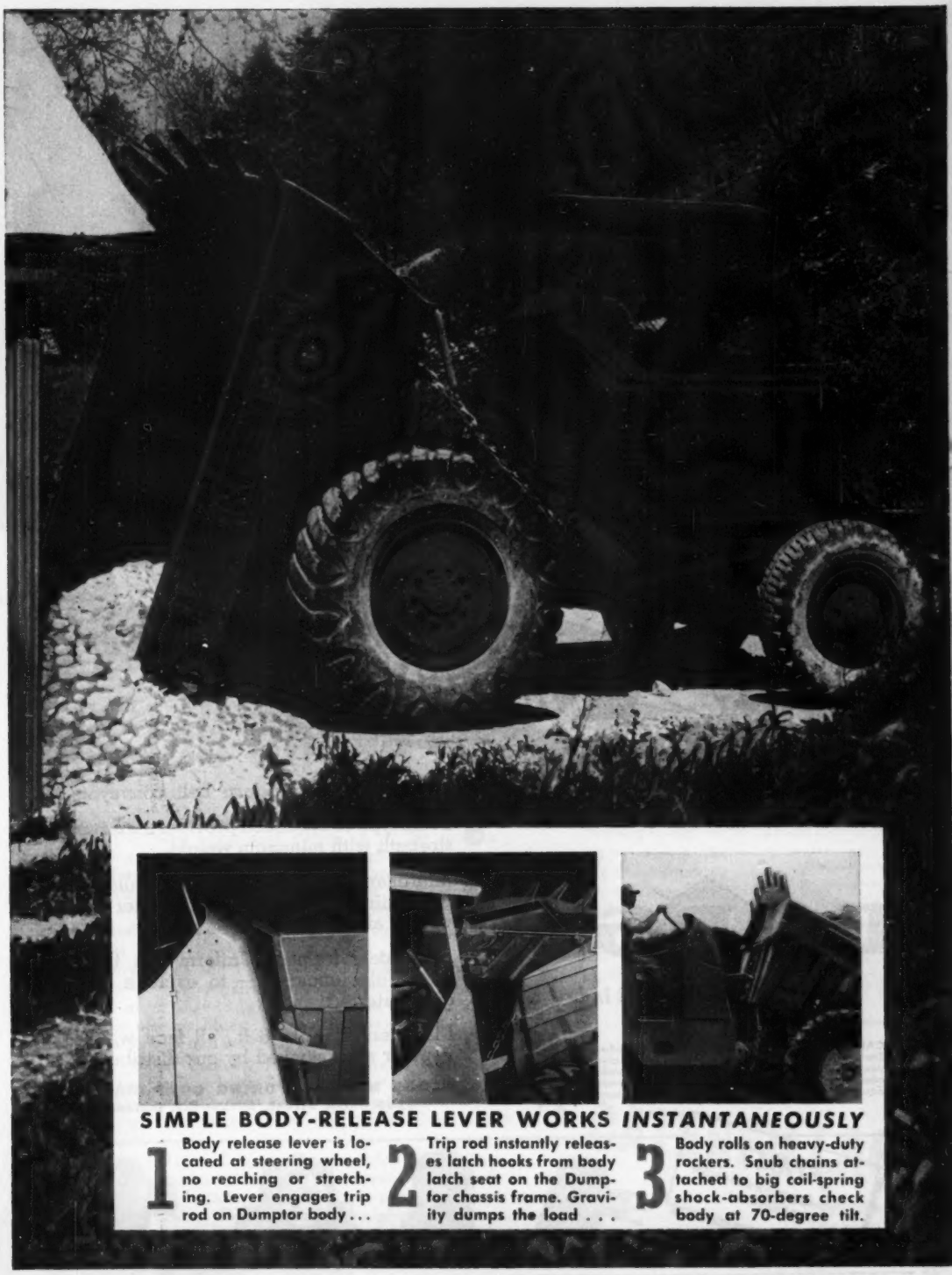
No costly spring maintenance is another money-saving advantage you get with Koehring Dumptors. There is just one big, double-coil chassis spring on steering axle . . . none on driving axle. Extra-big, shock-absorbing drive tires eliminate need for more. You save spring maintenance time and replacement costs.

Check your body hoist and spring maintenance costs for a year . . . see how much you'll save by using Dumptors. What's more, Dumptor's no-turn shuttle haul and constant-mesh transmission for 3-speed travel forward and reverse, increases production . . . and your profits. See your Koehring distributor now for all the facts . . . or send today for informative 28-page Dumptor catalog.

KOEHRING COMPANY, Milwaukee 16, Wis.
(Subsidiaries:) JOHNSON • PARSONS • KWIK-MIX

K120

KOEHRING DUMPTOR®
CRANES UP TO 79½ TONS LIFT CAPACITIES . . . . EXCAVATORS UP TO 2½ YARDS



SIMPLE BODY-RELEASE LEVER WORKS *INSTANTANEOUSLY*

1 Body release lever is located at steering wheel, no reaching or stretching. Lever engages trip rod on Dumptor body . . .

2 Trip rod instantly releases latch hooks from body latch seat on the Dumptor chassis frame. Gravity dumps the load . . .

3 Body rolls on heavy-duty rockers. Snub chains attached to big coil-spring shock-absorbers check body at 70-degree tilt.

- The pulley for *modern* belt conveyors.
- Drum type construction provides maximum strength with minimum weight.
- Interchangeable hubs simplify installation, positioning, removal — insure better con veyors at *less* cost.
- Accurately formed. Uniform rim thickness. Fully enclosed — to exclude dust, dirt, water.
- Diameters 6 in. to 8 ft., all face widths. Popular sizes stocked by our distributors.

DODGE of Mishawaka, Ind.

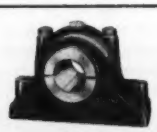
DODGE MANUFACTURING CORPORATION
3100 Union Street, Mishawaka, Indiana

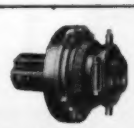
CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Equipment" in your classified telephone directory.

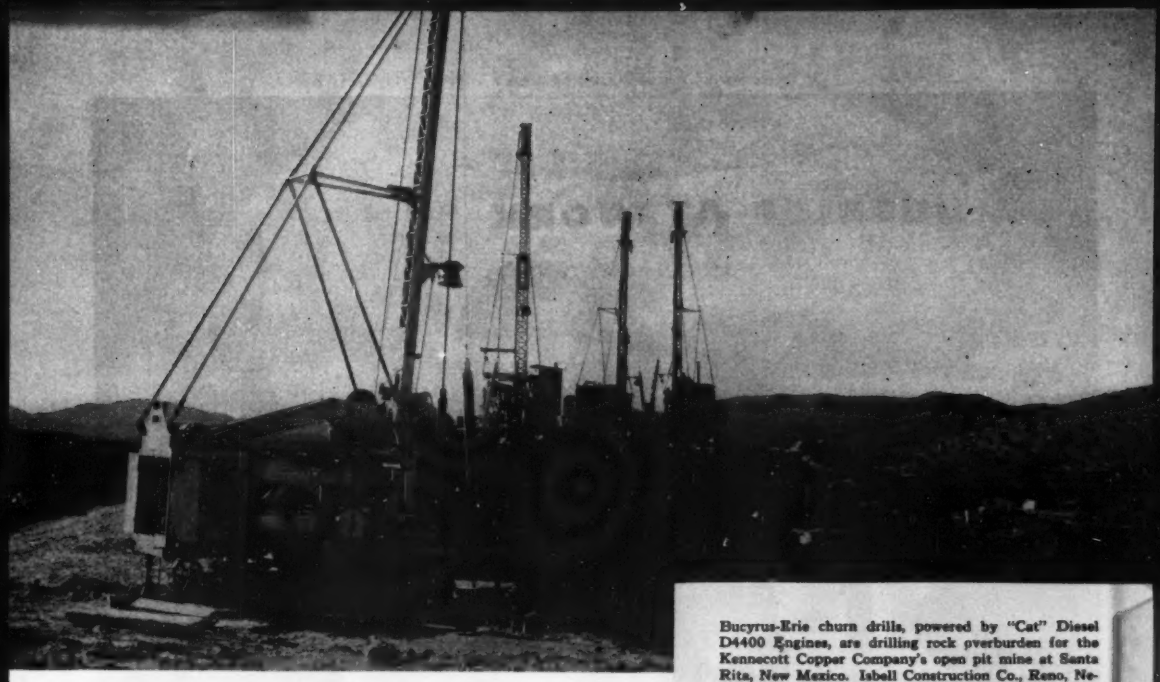
FIRST IN POWER TRANSMISSION MACHINERY!

V-BELTS AND TAPER-LOCK SHEAVES

TORQUE-ARM SPEED REDUCERS


DODGE-TIMKEN PILLOW BLOCKS


ROLLING GRIP AND DIAMOND D CLUTCHES



Bucyrus-Erie churn drills, powered by "Cat" Diesel D4400 Engines, are drilling rock overburden for the Kennecott Copper Company's open pit mine at Santa Rita, New Mexico. Isbell Construction Co., Reno, Nevada, is the contractor. A "Cat" Diesel No. 12 Motor Grader is used to maintain haul roads. Three "Cat" D8 Tractors complete the big yellow team on this operation.

There's a big job ahead

How your equipment stands up in the months ahead has a real bearing on America's fight to be strong and stay free. Our $2,800,000,000 mining production must be maintained or increased this year as a vital factor in defense. And we're entering a period when drilling machinery and other essential heavy-duty tools must stand up or else!

Military needs and Defense Rated Orders are taking their share of "Caterpillar" production. Shortages of steel and other materials add to the difficulty of supplying the demand for new machines. This means that *present equipment must be kept in use.*

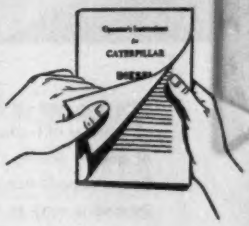
"Cat" Diesel Engines, Tractors, Motor Graders and Earthmoving Equipment are built with the stamina to serve you long and faithfully. But *how* long is up to you and the operation and maintenance you give them. Good care pays off.

You can add many hours to equipment life if you follow sound maintenance practices. Anticipate your parts needs *before* wear goes beyond repair. Talk it over with your "Caterpillar" dealer. He is qualified to give competent opinion. If a part is not readily available, he has the tools and knowledge to rebuild many worn parts — and keep your machinery on the job.

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

You're the Doctor

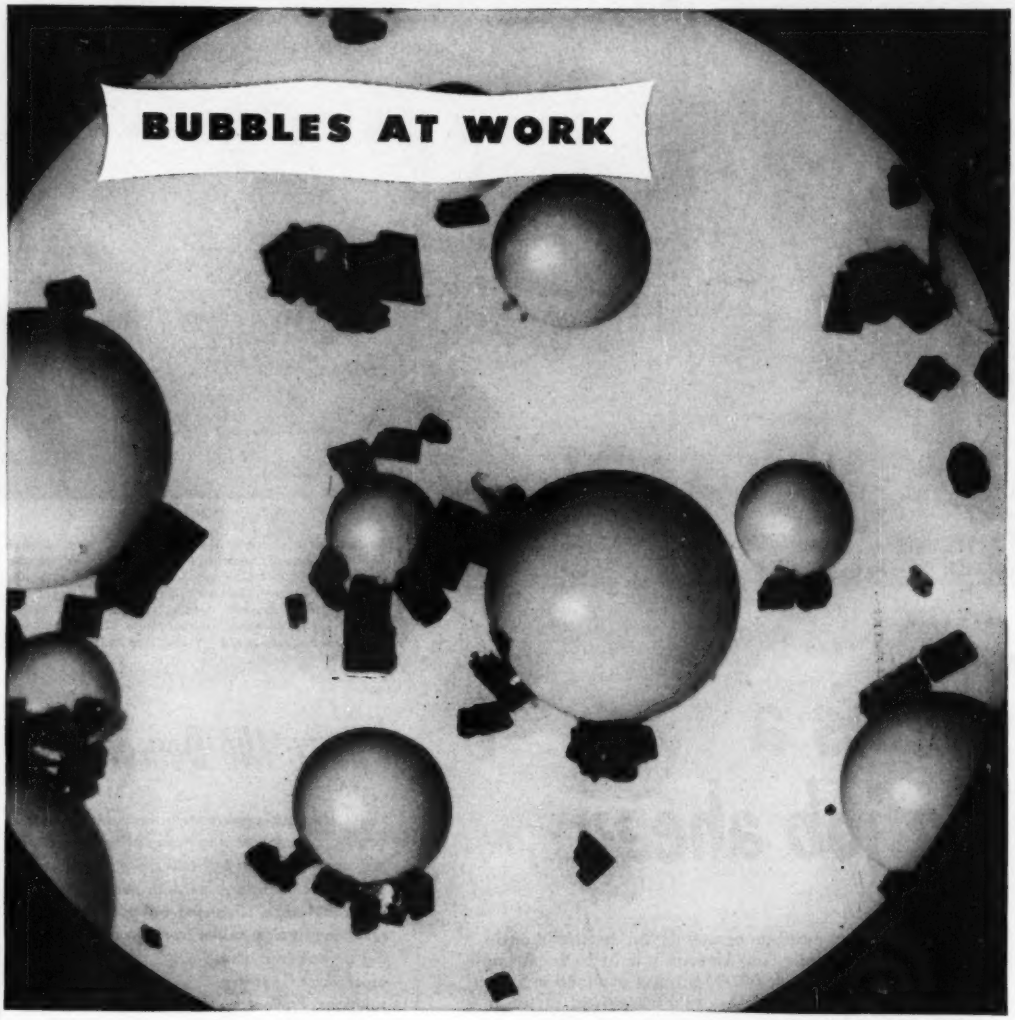
Don't let your engine overheat. Maintain the cooling system, keeping it free of scale, rust and sediment. Use soft or treated water and, when freezing temperatures exist, protect your engine with anti-freeze. Clean the radiator periodically, removing foreign matter from the core by brushing or washing. Use chemical flushing solutions. Prevent engine troubles which come with overheating. Consult your Operator's Instruction Book.



CATERPILLAR

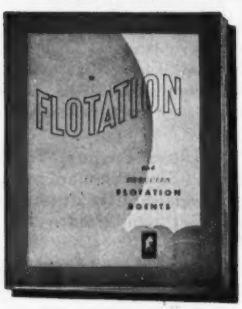
REG. U. S. PAT. OFF.

DIESEL ENGINES
TRACTORS
MOTOR GRADERS
EARTHMOVING EQUIPMENT



Photomicrograph greatly enlarged, by H. Rush Spedden

To help step-up flotation recoveries at low cost, Hercules has developed a number of frothers and collectors. Yarmor® F Pine Oil has been a standard of quality among pine oil frothers since the early 1920's. RADA (Hercules' Rosin Amine D Acetate) is a siliceous mineral collector that has good solubility and is easy to handle. It is used in the commercial flotation of several nonmetallic ores. These and other Hercules products are described in a 16-page technical booklet, "Flotation and Hercules Flotation Agents." This booklet also contains many formulas useful in the operation and control of modern ore-dressing mills. *Send for your copy.*



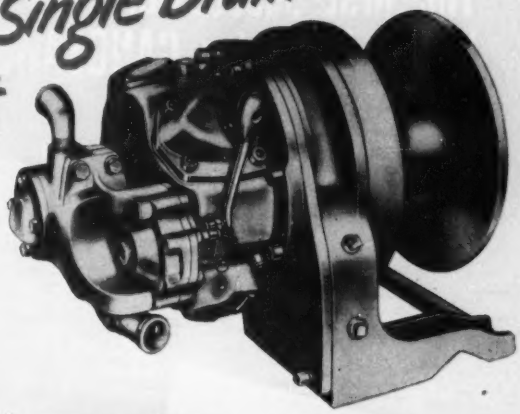
HERCULES POWDER COMPANY 933 King St., Wilmington, Delaware

HERCULES Flotation Agents

NM51-1

1851-1951 . . . 100 Years of Engineering Leadership

The Most Powerful Single Drum Per Unit of Weight



JOY DW-111 PISTONAIR HOIST

Yes, the DW-111 develops more horsepower per unit of weight than any other hoist in its class. This is no idle boast. Take a look at the figures—

Hoist A	.0082 H.P. per pound
Hoist B	.0103 H.P. per pound
JOY DW-111	.0115 H.P. per pound

This superior power with light weight is the result of modern compact design—design which has been developed through many years of intimate knowledge of hoisting requirements—plus the proper use of modern materials to produce a sturdy, heavy-duty hoist which will stand up under years of hoisting service with a minimum of maintenance. The DW-111 reversible, compressed air driven hoist has a 1200-pound lifting capacity.

AUTOMATIC SAFETY BRAKE

Increases safety and simplifies operation

The exclusive Joy automatic safety brake positively holds the load in any position when the throttle valve is in the "off" position. And the throttle valve has a spring return to the "off" position—making certain that there can be no slip-up. It's foolproof.

Joy manufactures a complete line of single drum hoists, shaft hoists, and two-and three-drum slusher hoists in capacities to meet your hoisting needs. ● *Write for further information, or . . .*

AD M 3798

JOY MANUFACTURING COMPANY

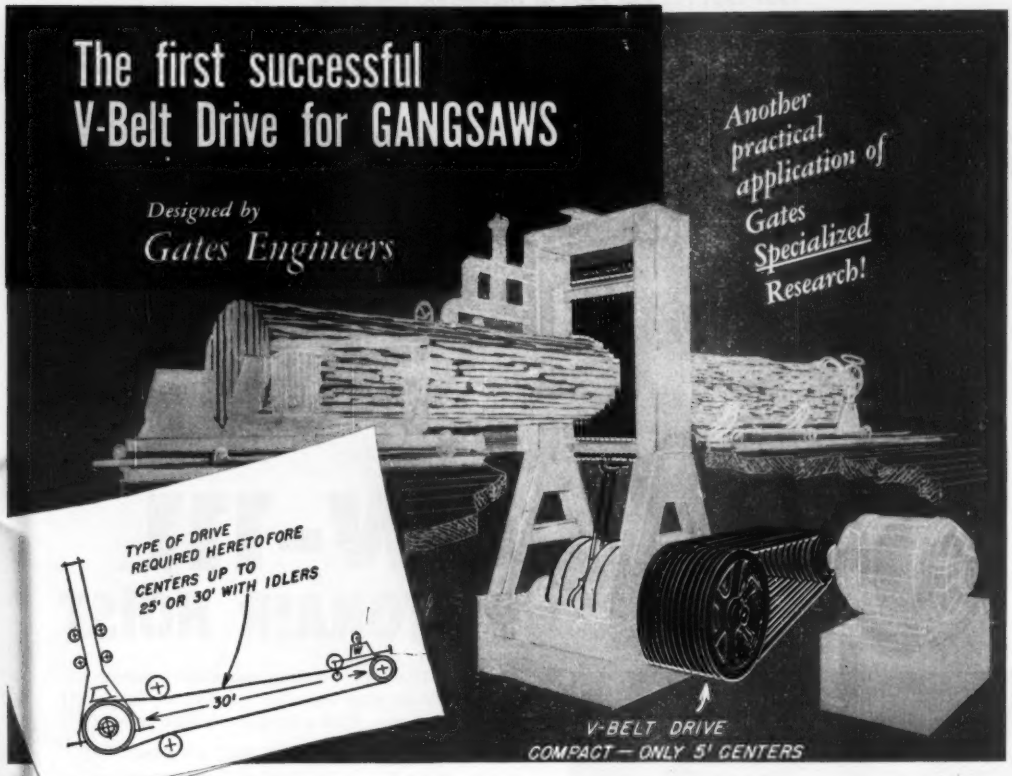
GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

The first successful V-Belt Drive for GANGSAWS

Designed by
Gates Engineers

Another practical application of Gates Specialized Research!



A large maker of gangsaws said to Gates Engineers, "If you can design a V-Belt drive to handle the *fluctuating load* on a gangsaw, we can discard the long and troublesome flat belt that we have always thought we had to use."

The *reasons* for his statement are quickly told:—

A gangsaw (or Swedish type Gang Mill) consists essentially of several saw blades mounted in a heavy steel frame or "sash" that moves rapidly up and down like a monster jig saw. This sash may weigh a ton or more—yet it makes about *five* 24-inch *up* and *down strokes per second!*

On the *up* strokes, the saws have no cutting load on them. But on the *down* strokes they must often slash a log up to 36" diameter into 2" planks. This great unbalance in load between the *up* and the *down* strokes has heretofore defeated all efforts to apply a V-Belt Drive to saws of this type.

After thoroughly analysing the fluctuating load on gangsaws, Gates Engineers recommended very minor changes in design which would permit the application of V-Belts and—what is of *utmost importance to you*—they were able to write down *in advance* the exact specifications of the V-Belt Drive that has very successfully handled this extremely difficult assignment.

This *pre-solution* of drive design problems is possible because Gates operates the largest V-Belt testing Laboratories in the World—and Laboratory findings are carefully checked by tests made under actual field conditions. Finally, the *results* of these exhaustive tests are immediately reduced to *usable data* for the design of V-Belt drives to *perform whatever task may be required.*

Phone a Gates Field Engineer

If you have a difficult drive to design, or if some drive in your plant is giving trouble, or if you only want to be sure what size and construction of V-Belts will give the most efficient and the lowest cost service on any particular drive—you have only to phone a Gates Field Engineer, *always near you* in all industrial centers.

Just look in your phone book under "Gates Rubber." A Gates Field Engineer will come right to your plant and put at your service the full benefits of Gates V-Belt knowledge and experience *without the slightest obligation!*

ENG. 515

Gates
Hose V-Belts
Molded Rubber Goods
for Industry

VULCO ROPE DRIVES
ENGINEERING OFFICES AND JOBBER STOCKS
IN ALL INDUSTRIAL CENTERS

THE GATES RUBBER COMPANY
DENVER, U.S.A.
The World's Largest Makers of V-Belts

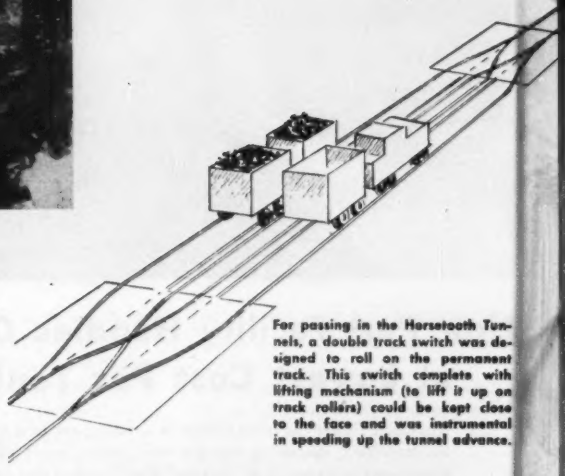
CASE HISTORY OF A SUCCESSFUL TUNNEL JOB

FROM THE EIMCO FILE T181

HORSETOOTH FEEDER TUNNEL

Specifications

Tunnel size 12' x 12'. Total length (4 tunnels) approximately 15,000 ft. Longest tunnel 9500 ft. Best daily advance 72'. Average depth of round 7½ ft. Average advance per shift 14'9". Average loading time 40 minutes. Loading machine—Eimco 40H.



For passing in the Horsetooth Tunnels, a double track switch was designed to roll on the permanent track. This switch complete with lifting mechanism (to lift it up on track rollers) could be kept close to the face and was instrumental in speeding up the tunnel advance.

Rock loading equipment must be made heavy-duty to withstand the shock and abrasion to which it is constantly subjected. For rock-loading underground, the equipment must not only be heavy-duty but it must be absolutely dependable.

Eimco's loading equipment is designed and built by men who have intimate knowledge and experience with rock handling conditions in remote and inaccessible places where breakdowns can mean job stoppage.

Each Eimco RockerShovel reflects this understanding of operational conditions. Each RockerShovel is made to stay on the job under the most trying conditions and for continuous, round the clock operation.

Thousands of these machines, in operation every day, in all the United States and fifty-three foreign countries have won the respect and admiration of all who use them.

That is why the great majority of metal mines have standardized on Eimco Rock-Loading Machines.

A241

EIMCO

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

EXECUTIVE OFFICES AND FACTORIES — SALT LAKE CITY 10, UTAH, U. S. A.

BRANCH SALES AND SERVICE OFFICES:

NEW YORK, 51-52 SOUTH STREET • CHICAGO, 3319 SOUTH WALLACE STREET
BIRMINGHAM, ALA., 2140 FAYETTE AVE. • DULUTH, MINN., 216 E. SUPERIOR ST.
EL PASO, TEXAS, MILLS BUILDING • BERKELEY, CALIFORNIA, P. O. BOX 240
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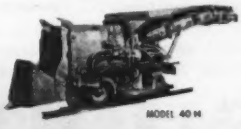
IN ENGLAND: EIMCO (GREAT BRITAIN) LTD., LEEDS 12, ENGLAND
AGENTS IN ALL PRINCIPAL CITIES THROUGHOUT THE WORLD

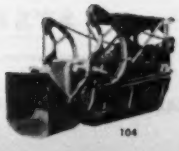
MODEL 12-B


MODEL 40 H

MODEL 21

MODEL 12

102


104

New Port Facility Handles Ores Faster at Lowest Cost Per Ton!

This S-A Conveyor installation is a vital part of a new port facility for handling incoming foreign ores faster, more efficiently and at lower cost per ton. S-A "Amsco" Pan Feeders and an S-A Belt Conveyor move iron, manganese, chrome and other ores from twin unloading towers to rail cars with a major time saving and at a minimum handling cost. Fast unloading means less port time per ship and more trips a year.

As a whole, and in detail, this heavy-duty system typifies the many and diversified bulk materials handling installations planned and outfitted by S-A engineers during the past half century. The S-A engineer is able to recommend the most practical combination of equipment units for each specific job—because Stephens-Adamson makes *all* types of bulk conveying equipment.

If you are considering a new or remodelled conveying system, write us.

BALTIMORE & OHIO RAILROAD
Port of Baltimore, Maryland

Grab buckets bring up 15 tons from the ship's hold in each "bite." Ore is deposited in the receiving bins of two giant movable unloading towers. In turn, the ore passes through S-A "Amsco" Pan Feeders in a measured flow to an 867-foot S-A Belt Conveyor. This travels horizontally under the towers and then up an incline to a 500-ton bin above the railroad tracks. Ore is again fed by pan feeders into weigh hoppers where it is weighed in carload lots and discharged through S-A power-operated gates to cars spotted below.

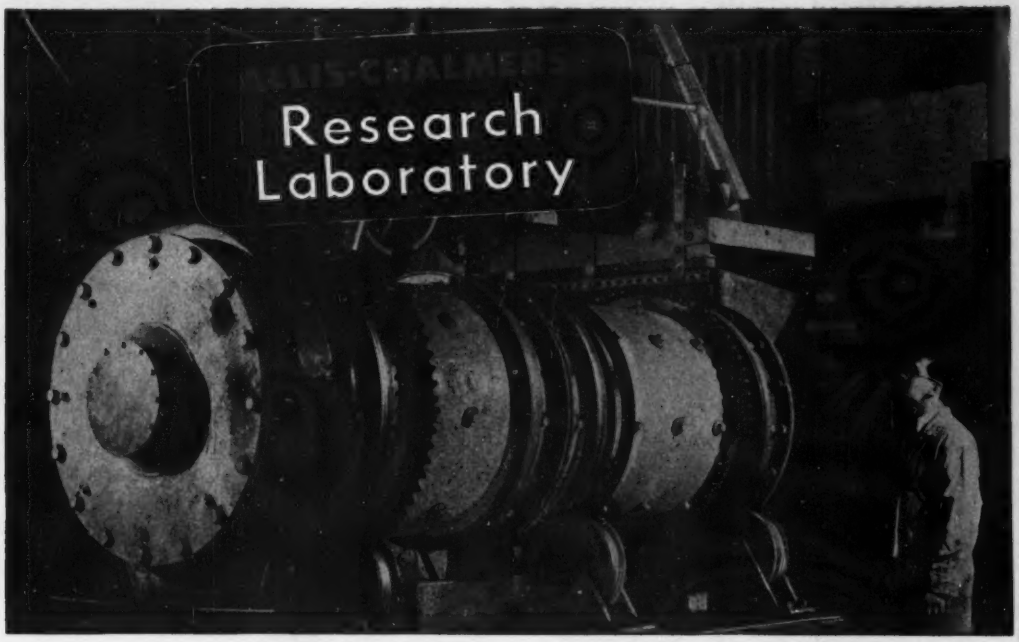
1901-1951

50 years experience with bulk handling

STEPHENS-ADAMSON MFG. CO.

4 Ridgeway Avenue, Aurora, Illinois · Los Angeles, Calif. · Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT



How Lab Tests Reduced Initial Plant Cost

A MINING COMPANY wanted to find a low cost method of crushing and dry grinding lead slag to a carefully controlled product of 98% passing 10 mesh. A method had been worked out previously which would meet these size specifications but which required a considerable amount of costly auxiliary equipment. The customer hoped that a simpler method might be found.

A 20-ton sample was sent to the Allis-Chalmers Research Laboratories for a pilot plant test run. Proper operating conditions were established, and it was proved that the required reduction could be achieved by open circuit dry grinding in an end peripheral discharge rod mill with no auxiliary equipment.

As a result of the Laboratory tests, this company was able to save money on the original plant investment. Simplified plant layout also resulted in low maintenance.

CAN YOU USE THESE FACILITIES?

The Allis-Chalmers Processing Laboratory was established to help you work out profitable solutions to processing problems. It contains modern equipment for batch and pilot mill tests in grinding, crushing, sizing, concentrating, pyro-processing, chemical and physical analysis.

The Laboratory's purpose is to develop new or more efficient processing methods...to determine the economics of a process prior to full-scale operation . . . to provide engineering information to guide in designing efficient plants . . . for virtually any type of industry.

Facilities of the Laboratory are available to anyone in industry. Charges are based on costs. Estimates for test work can be obtained from A-C district offices or from Allis-Chalmers Processing Laboratory, Milwaukee 1, Wisconsin.

Send For Your Copy Today

Laboratory Bulletin 07B6419B

Allis-Chalmers Mfg. Co.
Milwaukee 1, Wis.

Name _____

Company _____

Position _____

Address _____

City _____ State _____ A-3444

ALLIS-CHALMERS

Processing Research Laboratory — Dedicated to a Better Utilization of our Raw Materials

• • • • The world knows of America's fabulous steel production. It knows that our capacity to fashion the weapons of war is a fearsome thing.

And we know that steel has contributed more than any other industry to our daily lives. Everything we use . . . from toothbrushes to neckties . . . starts with steel.

The development of better refractories for every step in steel . . . and tremendous advances in production . . . have helped largely to make possible steel's progress. General Refractories is proud of its part.

Hot Air That Talks Sense

GENERAL REFRACTORIES

GENERAL REFRACTORIES COMPANY
PHILADELPHIA

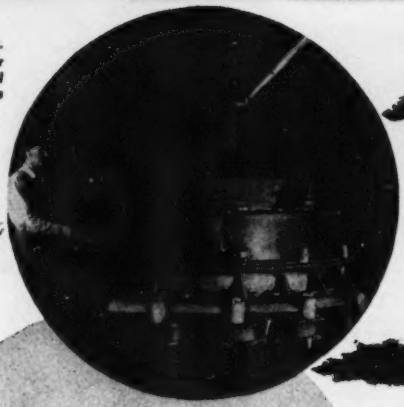
General's OLIVE HILL fireclay brick lines this blast furnace. And elsewhere in the plant you'll find General Refractories silica brick, basic brick, plastics, castables and bulk products. There's scarcely a heat application for which General does not supply a refractory.

General's extensive research facilities and modern production methods . . . General's 43 mines, 29 plants, 18 sales offices and 200 distributing agencies . . . are at your service. If you have a refractory problem, depend on the company that offers a complete refractories service.

A Complete
Refractories Service

Symons Cone Crushers

are used throughout the world to Increase Production of *Lead and Zinc*



RIGHT: This 7 ft. Symons Standard Cone Crusher is used for secondary crushing of lead and zinc ore by one of the country's leading producers.

Following are some of the great lead and zinc mining companies, selected at random from a list of Symons Cone Crusher users:

Aktiebolaget Zinkgruvor	Hecla Mining Company
American Zinc Company	Hudson Bay Mining & Smelting Co.
American Zinc, Lead & Smltg. Co.	Hanitor Mining Co.
Base Metals Mining Corp., Ltd.	New Jersey Zinc Co.
Bologet Vieille Montagne	Preussag Erzbergwerk Lautenthal
Cia. Industrial "El Potosi" S.A.	S. A. Miniere Cure di Predil
Consolidated Mining & Smelting Company, Ltd.	Sherman Lead Co.
Day Mines, Inc.	Silver King Coalition Mines Company
Eagle Picher Mining & Smeltjng Co.	Sidney Mining Co.
Empire Zinc Co.	Societe de Correbol
Gewerkschaft Augusta Victoria	Societa Mineraria e Metallurgica di Portovolo
Golconda Lead Mines, Inc.	St. Joseph Lead Co.
	Trepca Mines, Ltd.

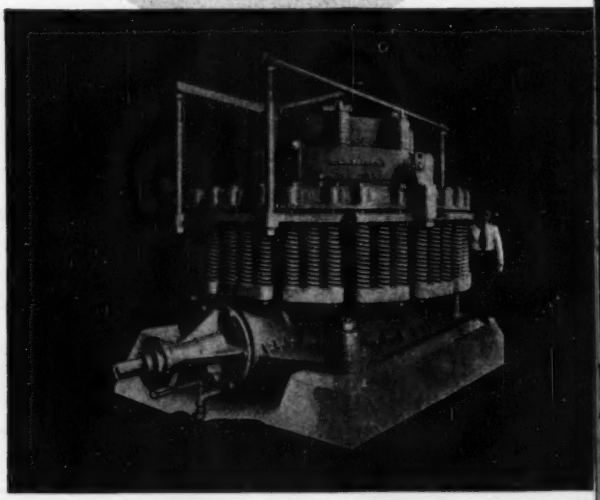
IN today's civilization, lead and zinc are high on the list of essential metals. In 1950 alone, recoverable lead and zinc amounted to over a million tons.

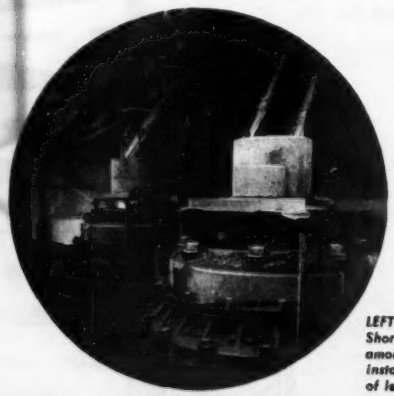
In order to increase production to meet the growing demands for lead and zinc, and to reduce the cost of their production through more efficient crushing operations, *most of the world's leading producers of these two vital metals use and prefer SYMONS CONE CRUSHERS.*

With features like uniform controlled feed—maximum liner utilization—positive protection against tramp iron—and trouble-free operation, it is easy to see why *there are more Symons Cone Crushers in use for fine reduction crushing than all competitive makes of gyratory reduction crushers COMBINED.*

Built in both "standard" and "short head" types, Symons Cones are unsurpassed for quantity production of all types of ores and industrial minerals.

Write for details on sizes and types to meet your needs.





M351

LEFT: These two 7 ft. Symons Short Head Cone Crushers are among the five Symons Cones installed by this large producer of lead and zinc.

NORDBERG MFG. CO.
MILWAUKEE 7, WISCONSIN
NEW YORK • SAN FRANCISCO • WASHINGTON • SPOKANE
MEXICO, D. F. • LONDON • TORONTO • JOHANNESBURG

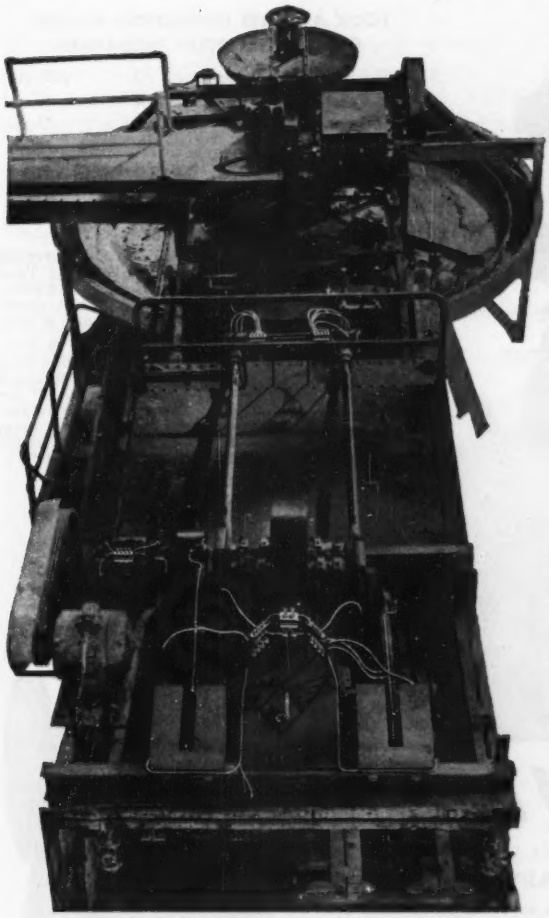
NORDBERG

Machinery for processing ores and industrial minerals

FARVAL—*Studies in Centralized Lubrication* No. 124

IN SOUTH AFRICA

Farval speeds gold production, saving lubricants, labor and bearing expense



Farval installation on a Dorr Bowl Classifier at the Venterspost Gold Mining Co., Ltd., Witwatersrand, Transvaal. Note the unusual method of mounting the 4 groups of valve blocks on special frames above the machinery.

● Pressed for more production, equipment at South African gold mines is operated around the clock. Any shutdown, as for lubrication or bearing repair, interferes seriously with gold output.

This need for uninterrupted operation led to a trial installation of Farval Centralized Lubrication by one company on a Dorr Classifier. Benefits were obvious immediately:

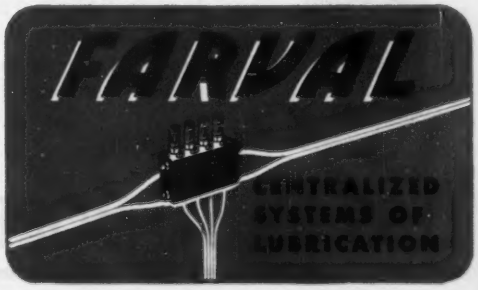
1. It is no longer necessary to shut down equipment to lubricate it.
2. Certain difficulties in gold extraction, formerly caused by presence of surplus grease are eliminated.
3. Dust containing cyanide is kept out of the bearings, thus reducing wear and saving repairs.
4. Lubricating labor is saved.
5. Waste is eliminated, with a consequent saving in grease of approximately 80%. This saving alone pays for the installation of Farval.

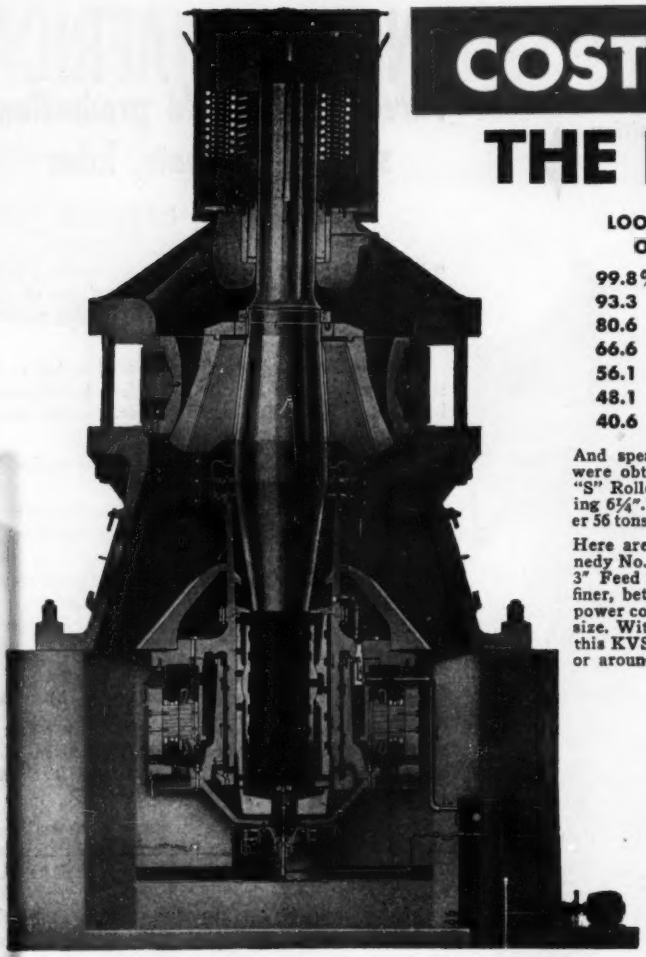
Results have been so amazing that, one after another, gold mining companies have tried out Farval Centralized Lubrication and then installed systems widely throughout their plants.

Farval is the original Dualine system of centralized lubrication, proved practical in 20 years of service. The Farval valve has only two moving parts—is simple, sure and foolproof, without springs, ball-checks or pinhole ports to cause trouble. Through its full hydraulic operation, Farval unfailingly delivers grease or oil to each bearing—as much as you want, exactly measured—as often as desired. Indicators at every bearing show that each valve has functioned.

Write for Bulletin 25 for full details. The Farval Corporation, 3281 East 80th Street, Cleveland 4, O.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.





COST DOWN THE KVS WAY

LOOK AT THESE GRADATION FIGURES ON CLOSED CIRCUIT OPERATION

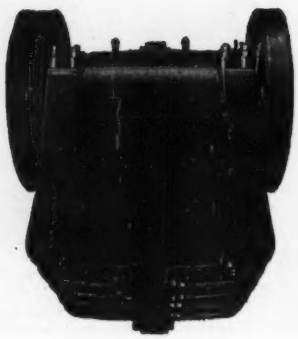
99.8%	Minus	3	MESH
93.3	"	4	"
80.6	"	6	"
66.6	"	8	"
56.1	"	10	"
48.1	"	14	"
40.6	"	20	"

And speaking of cost cutting—the above results were obtained from four No. 37½ Kennedy Type "S" Roller Bearing Gyratory Crushers. Feed opening 6¼". Discharge 7/32". Capacity of each crusher 56 tons per hour; power requirements 48 h.p. each.

Here are the results of another test run! A Kennedy No. 37½ Crusher with a Special Grinding Ring 3" Feed Opening gave 50% more product (and a finer, better product at that) for about HALF the power cost of a competitive crusher of a comparable size. With power costing say 1 cent per h.p. hour, this KVS saved some 40 h.p. (or about $11.00 daily) or around $3,000 a year. Think THAT over!

THE KVS WAY

We cut power costs in the "KVS" Swing Jaw Crusher. The STATIONARY jaw now carries 50% of the crushing load, instead of leaving it all to the SWING jaw. Another thing we cut way down is PARTS TROUBLE. The swing jaw is ALL IN ONE PIECE, except for the jaw plate. And that is removable. Note also—Swing and Stationary jaws are INTERCHANGEABLE, and reversible end for end. This means DOUBLE jaw-crushing life.

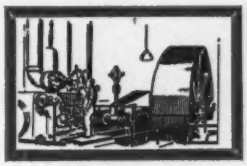


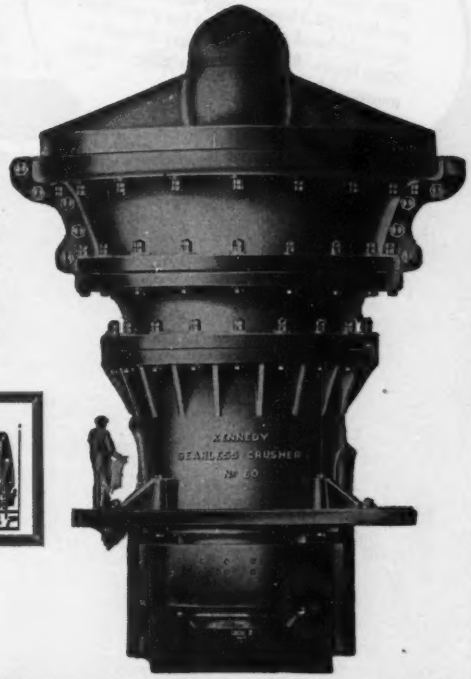
LESS COST MORE PRODUCTION WHEN

— PRODUCTION UP !!!

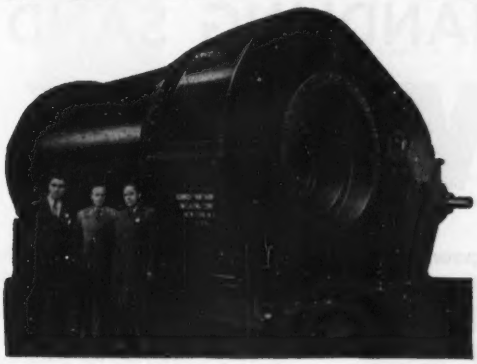
THE KVS WAY

In the "good old days," the big whirling flywheel or pulley of an old Corliss Engine produced extra KINETIC ENERGY! In other words, added FREE power! TODAY the BIG Revolving Pulley in the "KVS" Gearless does the same thing. It revolves at 3,500 ft. per minute—creates EXTRA crushing power for more production—without extra added cost. The 11 ton pulley (used in a "KVS" Gearless Crusher weighing 400,000 lbs.) turns so easily you can turn it on its roller bearings with TWO FINGERS! In simple words —more CRUSHING with LESS POWER, less vibration and less NOISE, too, has put the "KVS" Gearless way out in front when it comes to costs DOWN and production UP—and performance proves it





AND SAVE—THE KVS WAY!

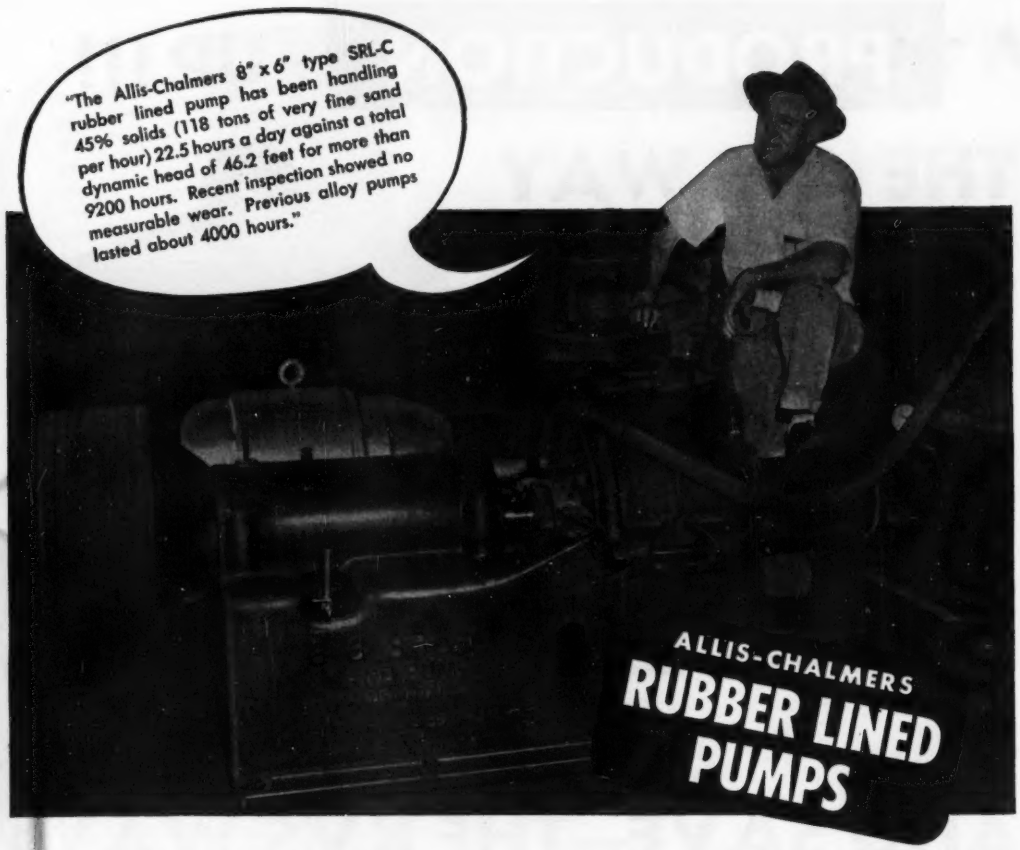


Thinking of buying a 10′ diameter ball mill? If so, you can save up to $5,000 by buying a "KVS" Mill with INTEGRAL GEAR drive and using a SYNCHRONOUS MOTOR DIRECT CONNECTED to driving shaft. Pinion shaft runs about 600 r.p.m. Pinion shafts in other mills run at about 180 r.p.m. "KVS" trunnions on large sized tube and ball mills CARRIED ON OIL. Bearing never wears out, uses little power. All gears and bearings automatically oil sprayed before mill is started (design pat'd). In 15 years on this type mill no "KVS" gears or pinions have worn out.

WRITE today for complete set of "KVS" Bulletins if you want MORE production with LESS cost.

Kennedy-Van Saun
MANUFACTURING AND ENGINEERING CORPORATION
2 PARK AVE., NEW YORK 16, N. Y.
FACTORIES:
DANVILLE, PA., U.S.A.
CANADA, ENGLAND, FRANCE, AUSTRALIA

YOU USE KVS . . . .


"The Allis-Chalmers 8" x 6" type SRL-C rubber lined pump has been handling 45% solids (118 tons of very fine sand per hour) 22.5 hours a day against a total dynamic head of 46.2 feet for more than 9200 hours. Recent inspection showed no measurable wear. Previous alloy pumps lasted about 4000 hours."
ALLIS-CHALMERS
RUBBER LINED
PUMPS

9200 HOURS HANDLING SAND

"No Wear"

HANDLING FLORIDA SAND mixed with rutile, ilmenite, zircon and monazite will grind any metal pump to pieces in short order. But this Allis-Chalmers rubber lined pump has been operating for more than a year with no measurable wear. 10 to 50 times the service life of the best metal alloy pumps is not an uncommon record.

Special Compounds Used

Rubber lining compounds are especially engineered for each application. Linings are bonded to steel frames and not to the pump body. Linings may be replaced without removing the pump from its location. The impeller is equally easy to remove and replace.

If you are pumping fine mesh, hard, abrasive materials (⅛" to 325 mesh size), you may find that an Allis-Chalmers SRL rubbed lined pump will mean longer life and lower costs per gallon pumped. Ask your nearby Allis-Chalmers District Office representative, or write Allis-Chalmers, Milwaukee 1, Wis. and ask for Bulletin 08B7311.

A-3476

ALLIS-CHALMERS

Are you turning in all your SCRAP?

Don't wait for "George" to do it

IF you are a steel user, this important job of getting more scrap back to the mills is directly up to *you*. You just cannot afford to sit idly by while the scrap shortage gets worse. For unless everyone really pitches into this job of digging out all the scrap possible, steel production is bound to suffer, and every steel user, in more or less degree, will suffer too.

More scrap means *more* steel—it's as simple as that.

Right now some mills have only a bare two-days' supply of scrap on hand. Others have even less. Some steel-making furnaces already have had to shut down for lack of scrap. The situation is serious. Only you can help improve it.

By turning in every piece of worn-out equipment, every obsolete tool and machine, in fact every pound of iron and steel scrap you can comb out of your plant, you'll be helping relieve the worst scrap shortage since Pearl Harbor days . . . and the steel industry will be able to produce more of the steel you need.

Remember—it takes at least one-half ton of scrap to make one ton of steel. To maintain steel's present high production schedules requires more than 1400 carloads of industrial scrap *every* day. So turn in your scrap—ALL your scrap—and keep the mills rolling. This is more than a shortage. It's an emergency that vitally concerns you—and us—and the Nation.

You'll find your local scrap dealers listed in the yellow pages of the phone directory.

This page would ordinarily be used to tell you about

U·S·S CARILLOY STEELS

but, because without SCRAP we cannot produce steel, we are asking instead for your all-out help in getting more SCRAP to the mills.

UNITED STATES STEEL COMPANY, PITTSBURGH · COLUMBIA STEEL COMPANY, SAN FRANCISCO
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM
UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

1-1348

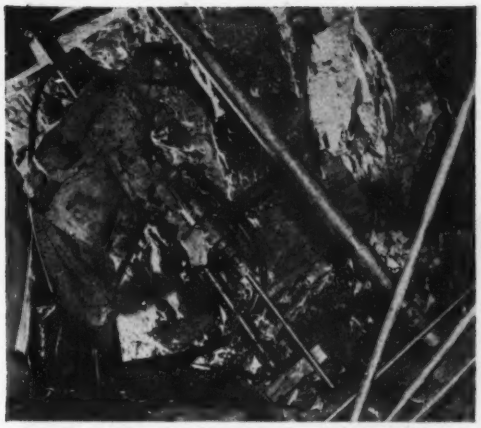
UNITED STATES STEEL

For exploratory drilling from the surface. Operating at the continuous high speed made possible by bortz bits, the CP No. 15HD DIAMOND CORE DRILL gives exceptional performance with remarkably low maintenance. With E-EX fittings it has a capacity of 2250 feet. The CP No. 8HD has a capacity of 1250 feet.

FROM EXPLORATION TO PRODUCTION

there's a CP drill

For maximum service from tungsten-carbide bits. The medium-weight, fast-hitting CP-34 STOPER and CP-50N DRIFTER are ideal for securing maximum footage from tungsten-carbide bits, because rotation, drilling speed and foot-pound blow are so balanced that excessive machine vibration is eliminated and long bit life assured.



For underground prospecting or blast hole drilling. With the fastest, most powerful rotary motor ever built into a diamond drill, the CP-55 DIAMOND DRILL is equally efficient for coring and blast hole operations.

For faster tunnel driving. Designed for maximum drilling speed and efficiency, the rail-mounted G-600 AIR ACTUATED DRILL JUMBO is furnished in single and multi-boom units. Rail mounted, for standard track gauges.

for every job

For general utility drilling. The CP-32 SINKER DRILL, in the 45-pound class, is designed for all-around service in medium to hard formations.

Write for detailed information

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

For shaft sinking and underhand stoping. The CP-59 SINKER outperforms any other drill in the 55-pound class, because of its exceptional drilling speed, strong rotation, powerful air blow, and excellent riding qualities.

"One man's meat is another man's poison..."

"I'm blasting a ditch. I want to throw that muck UP and OUT. The farther it flies the better. This is a good blast for me, because it's doing what I want—it's making ditch."

"I'm blasting for rock. I don't want to throw it up in the air. I want it broken and dropped for my shovels. Here much of the power of the explosives is going to waste. A mighty poor blast for me!"

The blast that is just right for one operator may be all wrong for another. A ditching shot like the one at left above is meat for the farmer or agricultural engineer. But such throw is strictly poison for blasting work in quarries, strippings and most construction jobs.

The ROCKMASTER Blasting System gives better control over explosives force—enabling you to strike the proper balance between throw and breakage—to suit *your* job.

Your Atlas representative will be glad to help you use the proper combination of the 16 available ROCKMASTER split-second delay detonators, plus explosives and loading methods especially suited to your requirements.

Write today for the ROCKMASTER "16" booklet, showing typical loading diagrams for several types of quarrying, stripping and construction blasting operations. It's yours for the asking.

ROCKMASTER "16" TIMINGS

Rockmaster No.	Avg. Time of Each Delay from Zero (milli-seconds)
0 (zero)	0 (inst.)
1	8
2	25
3	50
4	75
5	100
6	125
7	150
8	175
9	200
10	250
11	300
12	350
13	400
14	450
15	500
16	550

ROCKMASTER: Reg. U.S. Pat. Off.

ATLAS EXPLOSIVES
"Everything for Blasting"

CHEMICALS ATLAS EXPLOSIVES

ATLAS POWDER COMPANY, Wilmington 99, Del. • *Offices in principal cities* • *Cable Address—Atpowco*

What's ahead for you?

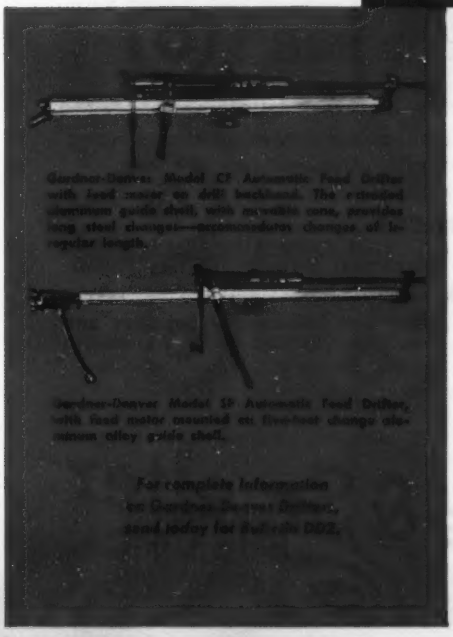
Increased demands for ore production from your mine?

A stepped-up development program to reach your ore reserves?

Hard rock you've got to "hole through" in a hurry?

A program to hold down production costs?

Gardner-Denver CF89H Automatic Feed Drifters.



For help in solving mining problems such as these, choose famous Gardner-Denver Automatic Feed Drifters. They're designed by men who know what it takes to do a fast, low-cost drilling job underground.

The Gardner-Denver self-adjusting feed, for example, responds automatically to bit penetration — is automatically regulated by the type of ground being drilled. Maximum drilling speed is easily maintained—"green" miners drill almost as fast as "old-timers." The long-wearing, "slow-motion" piston feed motor is economical to operate, too—uses only 3% to 5% of the total air consumption of the drill.

SINCE 1859

GARDNER-DENVER

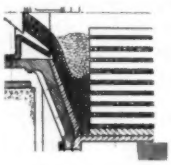
Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., Toronto, Ontario

THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS

ACTUAL INSTALLATIONS PROVE MARCY MILL DESIGN GIVES . . .

- **Greater grinding capacity**
- **More uniform grinding**
- **Less overgrinding**
- **Lower power consumption per ton of feed**
- **Lower maintenance costs per ton of feed**

Results are available to mill operators on comparison tests of grinding mills of equal size. In every instance the Marcy shows perceptible advantages in capacity and per ton costs. Competent, trained M & S engineers can give you the benefit of our long experience and complete milling data.



MARCY LOW-PULP-LINE FEED LINERS

give adequate feed pockets to meet the greater capacity of Marcy mills. Proper feed entry is essential to maximum grinding performance.

OTHER MASSCO PRODUCTS

Massco Fahrenwald Flotation Machines; Genuine Wilfley Tables; Massco-McCarthy Hot Millers; Rock Bit Grinders; Density Controllers; Belt Feeders; Rubber Pinch Valves; Assay and Laboratory Supplies and Equipment; Complete Milling Plants.

Main Office: DENVER, COLORADO, U.S.A.; El Paso; Salt Lake City; 1775 Broadway, New York, N. Y.; Canadian Vickers, Ltd., Montreal; W. R. Judson, Santiago and Lima; The Edward J. Nell Co., Manila, P. I.; The Ore & Chemical Corp., 80 Broad St., New York 4, N. Y., Representatives for Continental Europe.

The Mine & Smelter Supply Co.

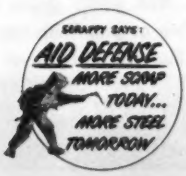
Set a definite day . . . soon . . . to start rounding up all the dormant scrap in your operation. Extra scrap is urgently needed to keep mills at expanded steel production.

Here's what's wanted

Steel producers must have scrap over and above the "working scrap" that you normally sell. Broken or obsolete machinery and equipment . . . odds and ends . . . worn out parts—in fact, *all* the iron or steel material that's rusting away in your plant or operation. Get it out of the way . . . get it on its way into production.

Here's what to do

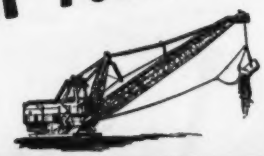
Set a definite day to start . . . make scrap collection the definite responsibility of one man or one group. Call your scrap dealer. He'll take all the scrap you can collect and pay you well for it.

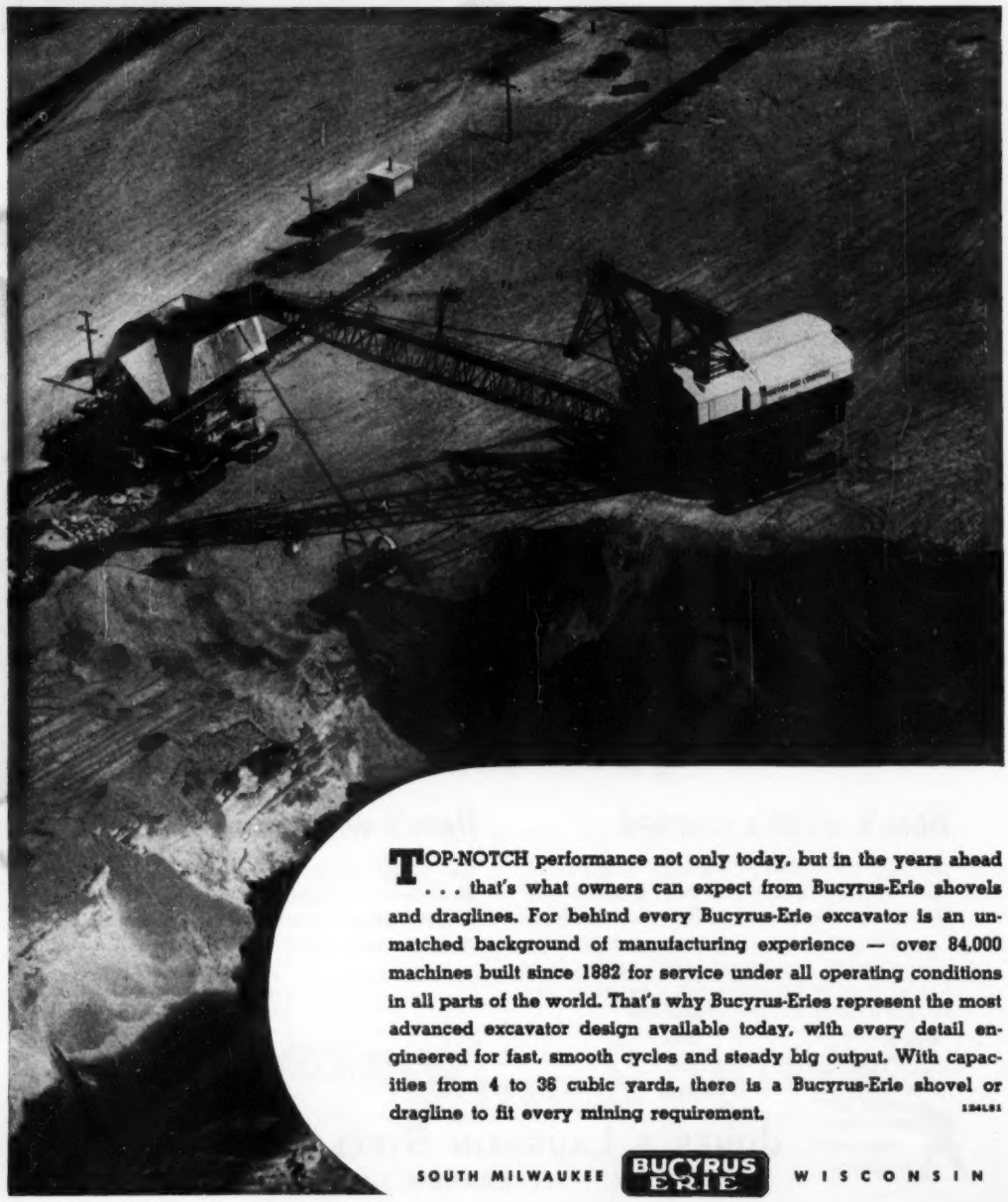


Set YOUR Scrap Day NOW!

JONES & LAUGHLIN STEEL CORPORATION
PITTSBURGH 30, PA.

DESIGNED FOR TOMORROW





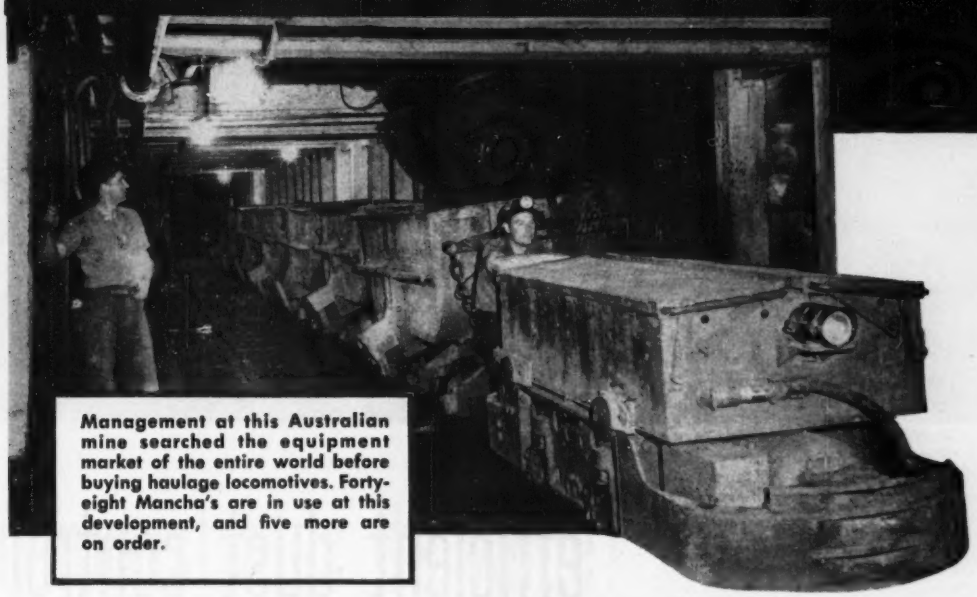
TOP-NOTCH performance not only today, but in the years ahead . . . that's what owners can expect from Bucyrus-Erie shovels and draglines. For behind every Bucyrus-Erie excavator is an unmatched background of manufacturing experience — over 84,000 machines built since 1882 for service under all operating conditions in all parts of the world. That's why Bucyrus-Eries represent the most advanced excavator design available today, with every detail engineered for fast, smooth cycles and steady big output. With capacities from 4 to 36 cubic yards, there is a Bucyrus-Erie shovel or dragline to fit every mining requirement. 1244L81

SOUTH MILWAUKEE BUCYRUS ERIE WISCONSIN

Search the world for the most efficient haulage locomotive

You'll choose MANCHA!

Storage Battery Locomotives proved for stamina, safety, and economy



Management at this Australian mine searched the equipment market of the entire world before buying haulage locomotives. Forty-eight Mancha's are in use at this development, and five more are on order.

MANCHA BUILDS THEM BIG...STRONG...WILLING!

- Mancha locomotives are built to haul a train of big cars all day long.
- Chassis design provides extraordinary strength, yet carefully limits weight so as to give every Mancha locomotive *extra battery capacity.*
- Battery energy is used *productively,* in moving muck, not wasted moving an unnecessarily heavy locomotive chassis.
- Antifriction bearings support all moving parts—hold frictional losses to a minimum.

Revamping your mine transportation system? Mancha offers the locomotives you need for your particular mine conditions. We invite you to take advantage of our thirty-five years of experience gained in the manufacture and application of mine locomotives.

Mancha Storage Battery Locomotive
Division GOODMAN Manufacturing Company
4850 South Halsted Street, Chicago 9, Ill., U.S.A.
EMMJ-951

Tell me more about Mancha locomotives.

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FIRM _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

MANCHA STORAGE BATTERY LOCOMOTIVE
Division GOODMAN Manufacturing Company
4850 SOUTH HALSTED STREET CHICAGO 9, ILL., U. S. A.

Without ROTO-CLONE dust control this dust source releases as heavy a concentration as any operation in the metal mining field.

efficient dust control..

ROTO-CLONES reduce costs... improve efficiency... in mechanized mining and processing operations

THIS IS A STORY of dust control . . . improved efficiency and reduced operating costs . . . in a highly mechanized mining operation. It's a story of coal dust, but might be dust from lead, copper, zinc, magnesite . . . or a dozen other types of minerals. ROTO-CLONES* "engineered" dust control successfully serves them all.

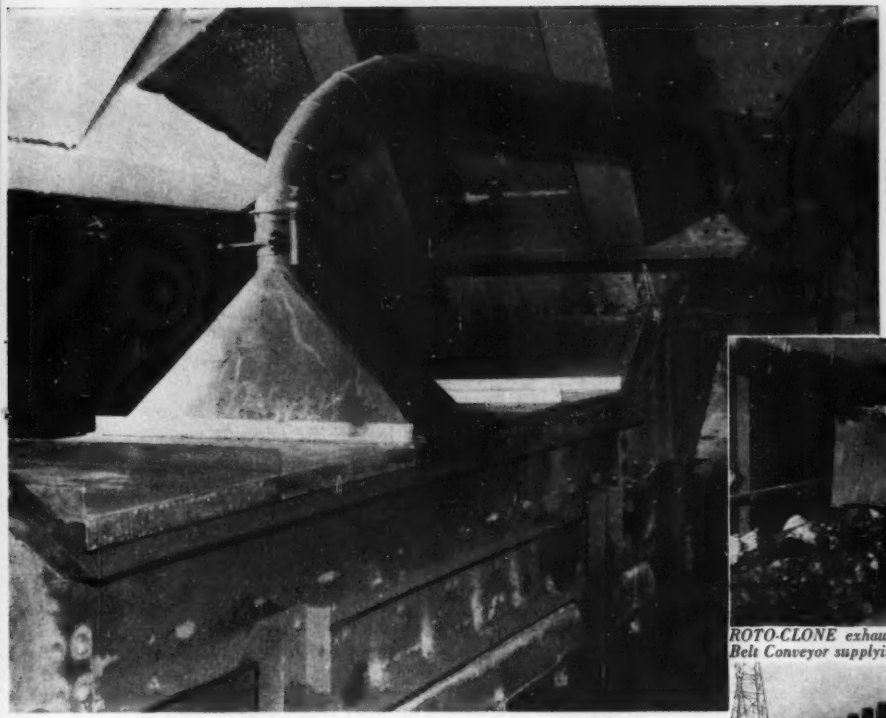
West Penn Power had a problem! Quantities of coal for power production are transferred from mine . . . to tipple and crusher house . . . by underground conveyors. The highly mechanized transfer and processing operations developed several severe dust sources. Water sprays for dust suppression proved inefficient . . . and costly . . . as the quality of the end product was impaired.

AAF Type N ROTO-CLONES exhausting 44,000 cfm, provided an efficient, economical answer to this problem. Clean air furnished by the ROTO-CLONES improved both human and mechanical efficiency . . . reduced costs by maintaining product quality.

In other types of mining operations ROTO-CLONES "engineered" dust control provides other savings. These include salvage of material from milling, sampling, sintering operations and greater control of product loss.

Be sure that dust is not dissipating your operating dollars. For full information on ROTO-CLONE dust control (including case histories) write direct to us.

®AAF



Hood over oscillating feeder exhausted by Type N ROTO-CLONE.

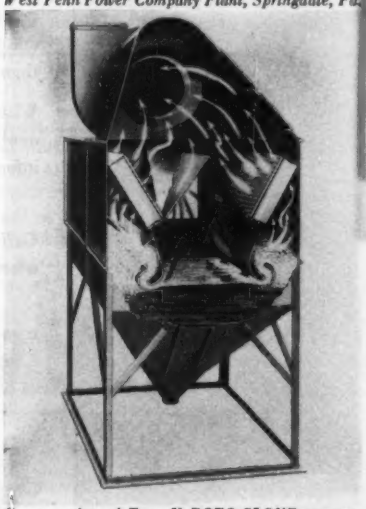
ROTO-CLONE exhausts take-off on discharge to Belt Conveyor supplying live storage.

West Penn Power Company Plant, Springdale, Pa.

demonstrates its value!

The TYPE N ROTO-CLONE is a dynamic precipitator of the hydrostatic type providing these performance characteristics:

- High efficiency in collecting both coarse particles and extreme fines in excessive concentrations.
- Dust collected in the hopper may be sluiced either continuously or intermittently.
- Continuous operation at peak efficiency without interruption for reconditioning.
- Minimum space requirements as single units perform functions of both exhauster and dust collector.
- Uniform air delivery assures sufficient air flow at hoods and unvarying air velocities in ducts at all times.
- Shop assembled and pre-tested for ease of installation.



Cross section of Type N ROTO-CLONE arrangement D with dual impeller showing water curtains created by air flow.

**ROTO-CLONE is the trade-mark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.*

American Air Filter
COMPANY, INC.

193 Central Ave., Louisville 8, Ky. • In Canada: Darling Bros., Ltd., Montreal, P. Q.

IF YOU'RE looking for minerals you can go about it in two ways: send out ground parties to make surface studies . . . or better still, direct your ground exploration with an air survey*.

Surveys by AERO with the airborne magnetometer are *fast*. They cost a fraction of ground surveys. They spotlight areas of greatest interest.

For example, take the recent iron ore discovery in Pennsylvania—*one of the most important finds in recent years*. Ground parties had explored the area continuously since 1917; there were no surface indications. But AERO's survey pointed to a massive ore body 1500 feet below the surface! "The discovery was made possible by a new aerial survey method using the magnetometer," says the mining company.

What was the cost of this survey? 7¢ an acre!

Yes, 7¢ an acre! And the 900,000 acre survey was flown in only 30 days. It's typical of how AERO cuts costs and speeds exploration programs. Moreover, AERO's magnetic records are accurate to better than one part in 10,000—a dependability achieved through AERO's more than a quarter million miles of aerial exploration.

With the airborne magnetometer AERO has helped uncover important new finds of chrome, asbestos, ilmenite and other minerals. For more information write AERO today.

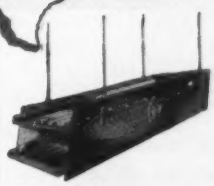
Call on* AERO'S *worldwide mapping experience when you plan your next exploration project.

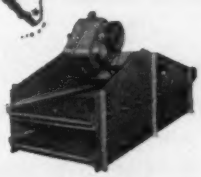
TOPOGRAPHIC MAPS • PLANIMETRIC MAPS
PRECISE AERIAL MOSAICS
AIRBORNE MAGNETOMETER SURVEYS
RELIEF MODELS
COLOR PHOTOGRAPHY

AERO
SERVICE CORPORATION
PHILADELPHIA 20, PENNSYLVANIA
Oldest Flying Corporation in the World

**There's a third way. You could hire a mystic and his divining rod!*

Want Help WITH SCREENING?





***RIPL-FLO* SCREEN**
A high capacity inclined vibrating screen with two-bearing mechanism. Low weight, maintenance, power requirement.

***LOW-HEAD* SCREEN**
A horizontal screen for wet or dry screening, rinsing or dewatering. Straightline motion. Saves headroom, space.

STYLE "C" SCREEN
Extra heavy duty screen particularly adapted for scalping. Handles pieces up to 3 by 4 ft, weighing 3,000 pounds.

***AERO-VIBE* SCREEN**
A sturdy, low cost vibrating screen for lump or granular materials. Makes separations 1½ in. square to 28 mesh.

***UTAH* ELECTRIC SCREEN**
Handles fine, granular materials from 10 to 48 mesh (dry) or 65 mesh (wet). Non-blinding device minimizes blinding.

ALLIS-CHALMERS district offices offer you the services of experienced vibrating screen engineers. In all mining areas are specialists who have the training and experience to help you get top screening performance and lowest screening costs for your job.

These experts will come into your plant, look over your present equipment, and suggest how your screening can be made a more profitable operation. Their recommendations are unbiased because Allis-Chalmers builds *all* types of vibrating screens . . . for *any* screening application. All Allis-Chalmers screens can be obtained complete with motor, drive and control.

Feel free to call on Allis-Chalmers for real help in solving screening problems. You'll be geting the finest engineering and experience available anywhere. Allis-Chalmers, Milwaukee 1, Wisconsin. A-3450

Pulverator, Low-Head, Ripl-Flo, Aero-Vibe and Utah are Allis-Chalmers trademarks.

ALLIS-CHALMERS

Sales Offices in Principal Cities in the U. S. A. Distributors Throughout the World.

Pulverators

Vibrating Screens

Jaw Crushers

Grinding Mills

Gyratory Crushers

Kilns, Coolers, Dryers

"What's Cookin'" on the other side of the mountain?

WHEN a locomotive engineer heads his train into a miles long tunnel under a mountain he wants to be reasonably sure that the track is clear not only in the tunnel but on the other side too. Frequently the only way he can get that information is through signal systems. When they are sitting on a siding signal cables may not look like much but once they are installed and connected they are a most important piece of equipment to a locomotive engineer.

Railroad Signal Cables carry a heavy burden of responsibility for the safety of passing trains. For that reason Railroad Signal Engineers are more often than not apt to be very "choosy" about the kind of signaling equipment they buy and install. More and more these days you will see Simplex-ANHYDREX Signal Cables like these being installed by railroads all over this country.

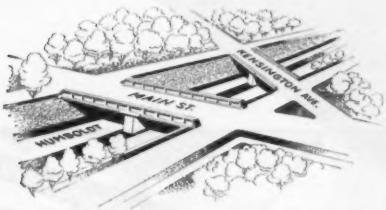
These cables are installed underground and overhead, in tunnels or in bright burning desert sunlight, on signal bridges across busy terminal tracks or buried in the slime and mud of swampy land. Why this trend to ANHYDREX Signal Cables? Because they are dependable. Regardless of the operating conditions if they are properly installed ANHYDREX Signal Cables will operate dependably year in and year out.

If you have a power, signal or control cable problem we will be glad to discuss it with you and make recommendations based on nearly seventy years experience.

SIMPLEX-ANHYDREX

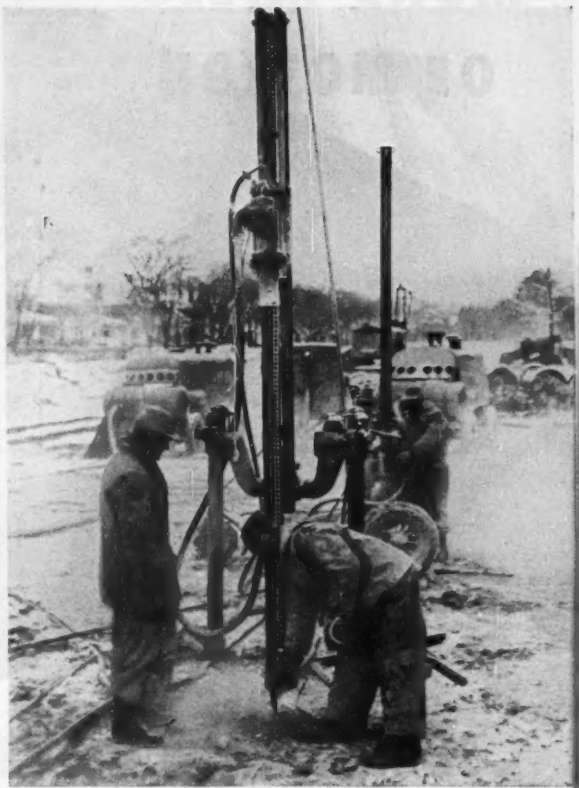
SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

70,000 Cubic Yards of Rock Blasted to Underpass Busy Buffalo Intersection



When three busy traffic arteries intersect there's bound to be a problem. Relief for one such situation is now under way in Buffalo. Main Street and Kensington Avenue are being underpassed by a four-lane, divided stretch of Humboldt Parkway about six blocks in length. This $2 million project will speed the flow of traffic and greatly reduce noise and confusion, as well as enhance the neighborhood.

The contract, awarded to Brunner Brothers, of Buffalo, by the New York State Department of Public Works, calls for 70,000 cu yd of rock excavation and about 7000 cu yd of trench and culvert work. Edward A. Besch & Sons, also of Buffalo, is the sub-contractor for all rock removal. Drilling and blasting right through the winter months, the contractors have relied exclusively on Bethlehem Hollow Drill Steel to bore about 150,000 ft of hole in hard, flint-streaked rock.



This chilly scene in February shows the wagon drills running full tilt as Bethlehem Hollow Drill Steel bites through hard grey lime in the initial stages of the excavation work.

Edward Penkalski and Charles Besch of Edward A. Besch & Sons, of Buffalo, examine the carbide-tipped, detachable bits used on rods of 1¼-in. round Bethlehem Hollow Drill Steel. Holes range up to 15 ft in depth. This project is scheduled for completion in December, 1951.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM HOLLOW DRILL STEEL

MORE MILES OF MOTION

Homocord CONVEYOR BELTS

Round and round—up and down they go, taking the hard impact of heavy loading . . . and still coming back for more . . .

Users tell us there are more ton-miles of rugged service in Homocord Conveyor Belts than in any other. This is not accidental; we engineered Homocord specially for heavy duty conveying. It cushions load-impact. It troughs naturally, needs less training. It's flexible, yet it's strong.

Bulletin 6906, mailed on request, presents convincing proof.

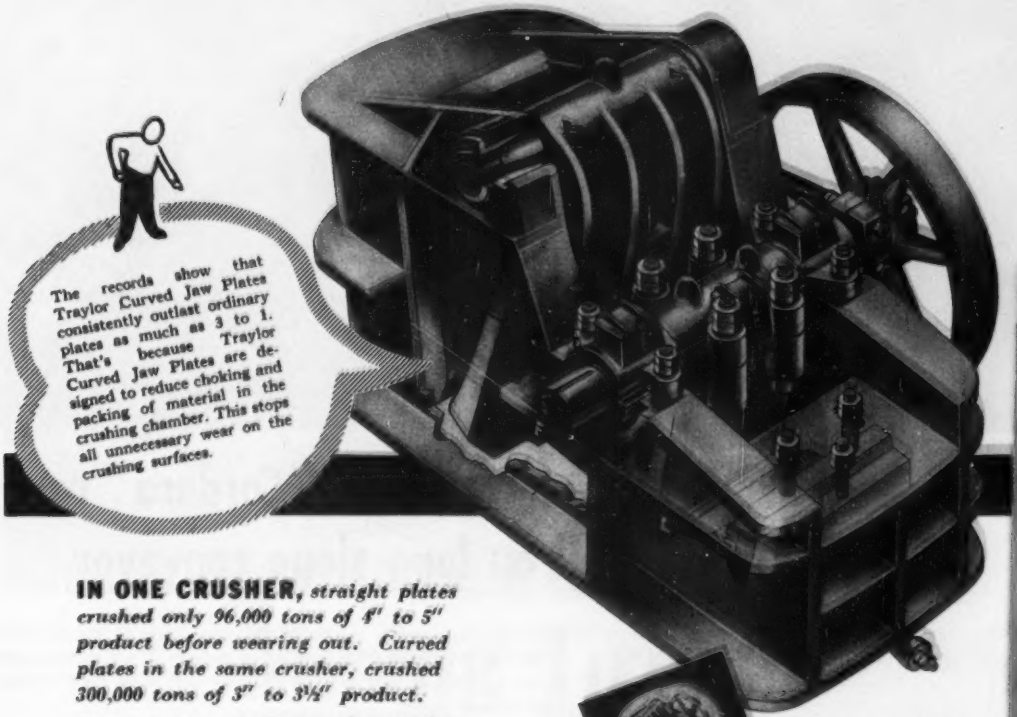
Our hose, V-belts and flat belts, too, are engineered for extra long life. Ask your R/M Representative.

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings Asbestos Textiles • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

Long Life of Curved Jaw Plates is a bigger reason than ever for buying a Traylor Jaw Crusher



The records show that Traylor Curved Jaw Plates consistently outlast ordinary plates as much as 3 to 1. That's because Traylor Curved Jaw Plates are designed to reduce choking and packing of material in the crushing chamber. This stops all unnecessary wear on the crushing surfaces.

IN ONE CRUSHER, ***straight plates crushed only 96,000 tons of 4" to 5" product before wearing out. Curved plates in the same crusher, crushed 300,000 tons of 3" to 3½" product.***

Keep an eye on the future, when you buy ore crushing machinery today. To insure continuous production, your best bet is to buy equipment that will require a minimum of maintenance and repairs. It may not be easy to get replacement parts when you need them most. Buy a Traylor Jaw Crusher . . . a crusher that has proved its ability to stay on the job 3 times longer between jaw plate replacements. Mail coupon for bulletin on the Traylor H Jaw Crusher today.

MAIL this coupon for complete information

TRAYLOR ENGINEERING & MANUFACTURING CO.
304-B MILL ST., ALLENTOWN, PA.

Send me free Traylor H Jaw Crusher bulletin #4105.

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SALES OFFICES: New York, N.Y.; Chicago, Ill.; Los Angeles, Calif.
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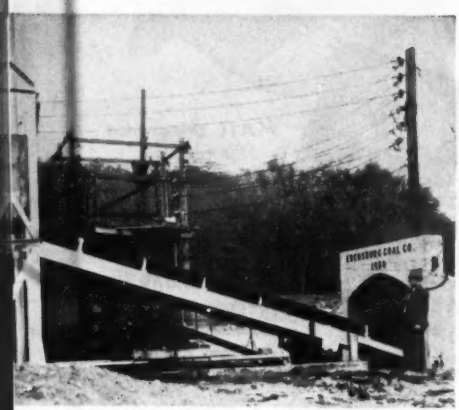
Jaw, Reduction and Gyratory Crushers · Crushing Rolls

A "TRAYLOR" LEADS TO GREATER PROFITS

Ebensburg Coal Co. installation proves that **Belt reinforced with "Cordura" rayon trains well on long slope conveyor**



12,000-pound tension has so little stretching effect on the "Cordura" rayon reinforced belt, above, that the counterweight moves less than one foot when starting with a loaded belt. This belt spans 1234 feet between centers and can carry 250 tons an hour. A 100-horsepower motor and mechanical speed reducer drive the belt 350 feet a minute up a lift of 266 feet. Inspecting the installation is Mr. T. L. Aitken, Vice President in Charge of Operations, Ebensburg Coal Co.

For nearly a quarter mile on a curved and varied course this 36-inch slope belt at the Ebensburg mine, Colver, Pa., trains perfectly. It was manufactured by Hewitt-Robins Inc. on a 5-ply fabric carcass made of Du Pont "Cordura"* High Tenacity Rayon.

Why do belts reinforced with "Cordura" rayon train better? For good reason: The inherent strength of "Cordura" rayon yarn enables manufacturers to make a belt thinner . . . with fewer plies . . . yet stronger. These thin belts are more flexible and sit firmly on the center idler whether loaded or empty, so they train better. They also have less tendency to crack and separate. And the low stretch of "Cordura" rayon saves expensive shutdowns for take-up and resplicing.

Before you order your next conveyor belt, inquire about the advantage of belts reinforced with "Cordura" High Tenacity Rayon. We'll be glad to send you the names of suppliers . . . also complete information about "Cordura" rayon, in a new booklet "Sinews for Industry." For your free copy write: Rayon Division, Room 4421, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

*REG. U. S. PAT. OFF.

Du Pont "Cordura" High Tenacity Rayon

STRENGTH AT LOW COST

DU PONT

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BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

Mining Tires
exactly fitted for their work

When we say "exactly fitted" we mean a mining tire built for the toughest conditions OFF THE ROAD, while giving a smooth long-wearing roll on the highway.

This *off-the-road* and *on-the-road* problem has now been solved. Both mining requirements have been fully met and mastered.

These are the facts about the U.S. ROYAL FLEETMASTER which can contribute to a radical reduction in your tire costs.

These U. S. Royal Fleetmaster facts add up to *reduced tire costs — increased efficiency — lower maintenance!*

- ★ ***70% Deeper Traction Tread!*** (For complete holding penetration OFF THE ROAD! With long-wearing smoothness on the *highway*)
- ★ ***Tougher, Stronger Carcass!*** (Permitting even greater additional safe mileage with more recaps)
- ★ ***Special Tread Compounds!*** (Utmost in cut and chip resistance)
- ★ ***Round-Moulded Carcass!*** (Natural inflated shape reduces distortion strain)
- ★ ***Thicker Under-Tread!*** (Your bed-rock for super-traction and mileage)

A phone call does it! **To your nearest U. S. Royal Distributor! He's listed in the Classified Telephone Book!**

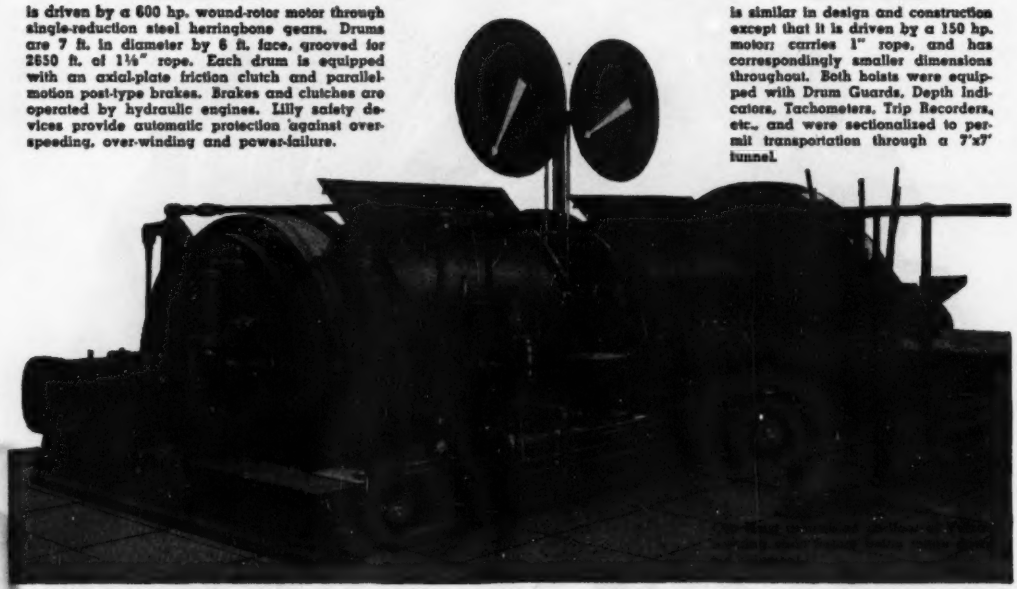
UNITED STATES RUBBER COMPANY

THE ORE HOIST

is driven by a 600 hp. wound-rotor motor through single-reduction steel herringbone gears. Drums are 7 ft. in diameter by 6 ft. face, grooved for 2650 ft. of 1¼" rope. Each drum is equipped with an axial-plate friction clutch and parallel-motion post-type brakes. Brakes and clutches are operated by hydraulic engines. Lilly safety devices provide automatic protection against over-speeding, over-winding and power-failure.

THE MAN HOIST

is similar in design and construction except that it is driven by a 150 hp. motor; carries 1" rope, and has correspondingly smaller dimensions throughout. Both hoists were equipped with Drum Guards, Depth Indicators, Tachometers, Trip Recorders, etc., and were sectionalized to permit transportation through a 7'x7' tunnel.



Modern Hoists for a Famous Mine

Nestling among the majestic peaks of the Cascade Range, near the northern boundary of the State of Washington, the Holden Mine of the Howe Sound Company (Chelan Division) is one of the World's most efficiently-operated copper producers. The fact that Vulcan recently furnished two similar outstanding hoists for this famous property is, therefore, a matter for legitimate pride and we take pleasure in presenting the accompanying illustration and data.

In this case, as on most other large hoist jobs, our engineers cooperated with the purchaser's engineers in developing a design to meet their particular requirements with highest possible efficiency and lowest ultimate expense. Besides having all other modern operating conveniences and safety features these two hoists are equipped with a distinctive system of dynamic braking, with single-lever control and safety interlocks, which, in itself, assures important savings.

Correspondence regarding any present or prospective requirement for specially-designed hoists is cordially invited and will receive prompt attention from our experienced engineering executives.

"ALLCASTEEL" SHEAVES

For each of the hoists described above we furnished two Vulcan "Allcasteel" Sheaves equipped with anti-friction bearings. Light, strong and highly resistant to rope wear, these sheaves are machined after heat-treatment and can be relied upon for many years of true-running, rope-preserving service.

VULCAN IRON WORKS

Established 1849

Main Office and Works **WILKES-BARRE, PA.,** New York Office 50 Church

Heavy-Duty Electric Hoists
Self-Contained Hoists
Scraper Hoists
Car-Spotting Hoists
Room Hoists

Shaking-Chute Conveyors
Chain Conveyors
Cast-Steel Sheaves and Gears
Cages, Skips and Gunboats
Coal-Preparation Equipment

Steam Locomotives
Diesel Locomotives
geared and electric drive
Gasoline Locomotives
geared and electric drive

Load-Carrying Larries
Rotary Kilns, Coolers and Dryers
Crushing Rolls and Pulverizers
Briquetting Machines
Ball, Rod and Tube Mills

Trunnion Bearing Engineered to End Alignment Troubles

ALLIS-CHALMERS
GRINDING MILLS

Allis-Chalmers builds trunnion bearings in 10 standard sizes from 14x8 to 54x22 in. The six smallest sizes are available as grease-lubricated; seven largest, as oil-lubricated bearings.

BALL AND SOCKET design of this Allis-Chalmers trunnion bearing provides a spherical seat that corrects for *any* minor misalignment of mill and bearing. Load is always distributed evenly across the full face of the bearing.

A complete, self-enclosed oiling system is contained in the bearing housing. Soft babbitt cannot score polished trunnion surface.

Large oil-lubricated trunnion bearings are provided with a hand-operated lubricant pump for floating the mill prior to starting. This eliminates high starting torque, an important feature, since 75 percent of bearing wear occurs during initial starting after shut-down. Motor inrush current is decreased.

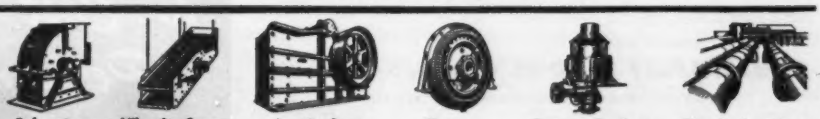
Allis-Chalmers builds trunnion bearings in lengths approximately one-half the diameter, in agreement with the latest engineering trend. Ample bearing area keeps bearing pressure low, prolongs bearing life.

The Allis-Chalmers representative in your area can give you more facts about bearings and other features of Allis-Chalmers grinding mills. Allis-Chalmers, Milwaukee 1, Wisconsin. A-3479

Pulverator is an Allis-Chalmers trademark.

ALLIS-CHALMERS

Sales Offices in Principal Cities in the U. S. A. Distributors Throughout the World.



Pulverators | Vibrating Screens | Jaw Crushers | Motors | Gyratory Crushers | Kilns, Coolers, Dryers

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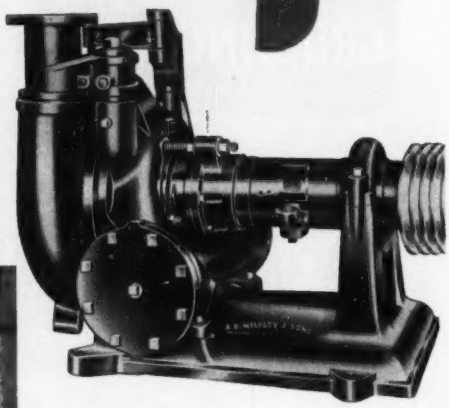
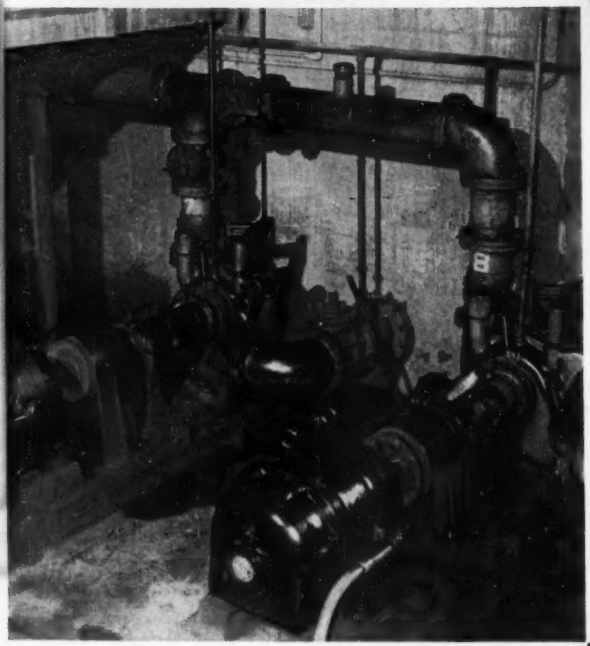
WILFLEY centrifugal PUMPS





This installation of Model "K" WILFLEY pumps handles middlings in a modern copper mill in Mexico. The pumps operate continuously on a 24-hour, trouble-free schedule. The Model "K" is a companion to the famous WILFLEY Acid Pump.

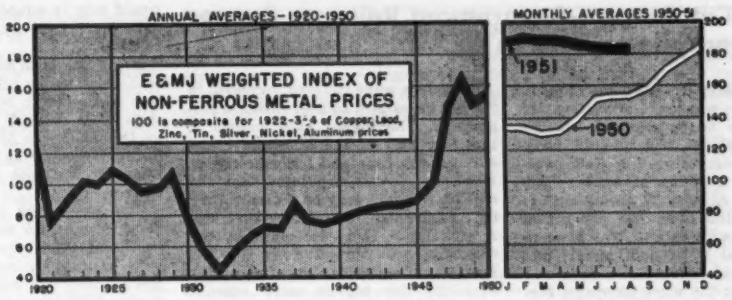
Important mechanical improvements and refinements in the new Model "K" WILFLEY Sand Pumps save power and production dollars—deliver stepped-up 24-hour-a-day performance and low cost operation. These pumps are noted for efficiency and economy in handling sands, slimes, sludges and slurries. Easy interchangeability of wear parts. Low maintenance. Continuous, 24-hour operation without attention. Individual engineering on every application. Write or wire for Model "K" Bulletin 200.

A. R. WILFLEY & SONS, INC., Denver, Colorado, U.S.A.
New York Office: 1775 Broadway, New York City

Buy **WILFLEY** *for Cost-Saving Performance*

E&MJ OUTLOOK

PRICES


ANNUAL AVERAGES—1920-1950
E&MJ WEIGHTED INDEX OF NON-FERROUS METAL PRICES
100 is composite for 1922-3-4 of Copper, Lead, Zinc, Tin, Silver, Nickel, Aluminum prices
MONTHLY AVERAGES 1950-51
1951
1950
J F M A M J J A S O N D

•

MARKETS Thanks to the RFC's downhill drag on the tin price, *E&MJ's* index of non-ferrous metal prices dipped to 186.15 in August, from July's mark of 186.44. Actually, metal prices are strong as ever.

In fact, pressure of acute metal shortages and higher wage costs, rising from the copper strikes, and of higher foreign metal prices, may force OPS to allow domestic metal price increases.

•

LABOR These were the copper strike possibilities as August ended:

1. Kennecott's settlement for a 15¢ an hour increase may not be followed by other major producers, may still face a fight at Kennecott, owing to union's insistence on industry-wide acceptance.

2. Kennecott's settlement might be accepted by others, especially if Government grants them price relief.

3. Truman will get men back to work via Taft-Hartley injunction, but problem of industry-wide bargaining is unsolved. (See p. 101.)

•

AT HOME The real bite of defense consumption, now just beginning, will test Washington's firmness in forcing consumption and inflation controls on protesting civilians. In an election year, the Government will probably compromise.

A new nickel strike on edge of Duluth gabbro in Minnesota looks promising. It will probably launch investigation of similar contacts.

Jess Larson will start with lots of industry backing as DMPA administrator. Howard Young, American Zinc president, and Simon Strauss, AS&R vice-president, will help get things going.

Larson will probably step up use of Government's loan powers to aid mineral output, with RFC acting at home and Ex-Im Bank abroad.

Keep an eye out for cerium minerals. The metal's badly needed to enable hot-working of heat resistant steels, as in jet engines.

Industry's view is that enough sulphur is now in sight to end the world shortage in 1953. Freeport, for example, will spend up to $15,000,000 developing a new 500,000-ton-a-year Louisiana property.

•

ABROAD Gold prices in the world's free markets rise with war scares and sink with peace feelers. During the last half of August they strengthened, with trade volume up 20%. (See Markets, next page.)

Chile's set-aside of 20% of local copper production will probably be sold on world markets at about 54¢ per lb. Of course, producers will turn this metal over to the Government at 27½¢.

MARKETS—Trends and Prices

Strikes Cut Output—Government Releases Copper From Stockpile to Relieve Growing Shortages

DESPITE EVER-TIGHTENING CONTROLS in non-ferrous metals, difficulties in meeting the heavy demands of the combined defense and civilian boom have been increasing. To make matters worse, a strike of some 58,000 workers on August 27 threatened to cut deeply into domestic production of copper, lead and zinc, not to mention essential by-product metals and sulphuric acid.

Aside from the work stoppage, certain to be of short duration because of its "very serious impact on the defense program," the industry has been forced to get along wth reduced imports.

The Government obtained an injunction on Sept. 6 and workers were ordered to return to their jobs.

The industry was surprised to learn that President Truman authorized the release of 25,000 tons of copper from the stockpile to offset a shortage caused by the strike at the Garfield smelter of AS&R Co. in July. However, it was stated in official circles that the stockpile is to be reimbursed by a like amount before June 30, 1952. As August ended, consumers of lead and zinc felt encouraged on news from Washington to the effect that the National Production Authority has proposed to the Munitions Board that lead and zinc to the extent of 25,000 tons each should be taken out of the stockpile because of the emergency.

OPS Price Relief

Effective August 10, the Office of Price Stabilization exempted from the General Ceiling Price Regulation nine critical imported minerals and domestic quicksilver. The imported items were asbestos, beryllium, chrome ore, columbite-tantalite ores, graphite, cobalt, manganese ore, kyanite, and acid-grade fluorspar. Exemption was granted to avoid any interference with the flow of needed supplies.

In exempting domestic quicksilver, the order frees those producers who were unable to take advantage of the higher market. Some producers had a ceiling under the general price freeze of $180 per flask, whereas the current market price is around $195.

A lower average for tin, based on the daily quotation of RFC, resulted in another moderate drop in our price index. The figure for August was 186.15, against 186.46 in July and 160.67 in August a year ago.

The Federal Reserve Board's index of industrial production declined in July to 213% of the 1935-39 average, against 222% in June.

Railroads were granted increases in freight rates of 6 to 9%, effective August 28. The higher rate applies to territory east of the Mississippi and north of the Ohio and Potomac rivers. However, it was stipulated that the rate on iron ore may be no more than 6%, regardless of territory involved. A plea for a 15% rise made by the railroads was turned down by the Interstate Commerce Commission. The authority for higher rates extends only to Feb. 28, 1953.

Copper Deliveries High

Deliveries of refined copper in July amounted to 101,095 tons, making the total for the seven months 772,461 tons. In the same period of 1950, deliveries totaled 784,083 tons. Owing to a decline in imports of copper and a reduced intake of scrap, producers had a difficult time in maintaining the heavy movement of the metal to fabricating plants.

Production of primary crude copper in the United States, equivalent roughly to mine output, totaled 575,774 tons in the Jan.-July period of 1951, against 528,346 tons in the seven-months' period of 1950.

Imports of copper in the first half of 1950 and 1951, in tons, follow:

	Jan.-June 1950	1951
In ore, matte, etc.	58,396	51,904
In blister	97,543	79,876
Refined copper	171,844	114,328

Chilean authorities have set a price of $1,200 per metric ton on sales of electrolytic copper coming out of the 20% set-aside. This is equivalent to slightly more than 54¢ per pound. Chilean producers deliver this copper to the authorities in that country under the new agreement on the basis of the world price, which at present is 27½¢ per pound.

The domestic market for copper remains strong at 24½¢, Valley, with most operators holding to the view that it will have to rise eventually to the higher level established abroad.

Action on Lead Duty

The House passed the measure that would suspend the lead duty, with safeguards as to price, on August 13. Owing to pressure of other legislation, the Senate has not yet acted on the bill. However, favorable consideration by the Senate is expected. Elimination of the import duty for the period of the emergency and an upward adjustment in the domestic ceiling to a level approaching that of foreign lead would help in establishing a more normal marketing situation, producers believe.

Beginning with September, domestic lead went under allocation. The plan was disrupted to some extent by the strike that shut off production at Selby, Omaha, Perth Amboy, and Kellogg. Consumers were agitating for the release of stockpile lead to maintain their operations.

Zinc production suffered somewhat along with copper and lead. A meeting in Washington between industry and OPS representatives to discuss the pricing situation occurred late in the month. OPS leans toward establishing specific ceiling prices at various key points. The industry can see no good coming out of such a change. Pricing of zinc recovered from higher-cost foreign concentrates also enters into the pricing problem.

The RFC maintained its price of Grade A tin at $1.03 per pound, New York, throughout the month. It has not abandoned its stand on establishing reasonable prices, even though

Average Prices for August (E&MJ Quotations)

Copper:	
Electrolytic, domestic, refinery	24.200
Electrolytic, Export, Refinery	27.425
Lead:	
Common, New York	17.000
Common, St. Louis	16.800
Silver and Sterling Exchange:	
Silver, New York, per oz.	90.160
Silver, London, pence per oz.	78.500
Sterling Exchange, "Checks"	279.921
Zinc:	
Prime Western, East St. Louis	17.500
Tin:	
New York Straits	103.000
New York, 99% min. (e)	102.000
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$195.852
Antimony (E&MJ) (d)	45.307
Antimony, bulk, Laredo	42.000
Antimony, in cases, Laredo	42.500
Platinum, refined, per oz.	$90.000
Cadmium (a)	255.000
Cadmium (b)	267.500
Cadmium (c)	280.000
Aluminum, 99% plus, ingot	19.000
Magnesium, ingot	24.500
Nickel (f)	56.500

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.
(a) Cadmium average based on the producers' quotation.
(b) Cadmium average based on the average of the producers' and platers' quotation.
(c) Cadmium average based on platers' quotation.
(d) Domestic, 5 tons or more but less than carload lot, packed in cases, f.o.b. New York.
(e) Tin content.
(f) F.o.b. Port Colborne, U.S. duty included.

mine operators claim that the market has been depressed to the point where output is bound to suffer.

Bolivian producers who have been shipping concentrates to the RFC again agreed to accept $1.12 as the settling basis for another month. Negotiations for a long-term contract have not yet been concluded.

Quicksilver was unsettled and lower, being available at $195 per flask, New York, or well below import parity on Spanish metal.

Manganese ore was in demand at higher prices. Indian ore of good quality settled at $1.25 to $1.30 per long ton unit, c.i.f. U. S. ports, duty extra.

"Free" Gold Prices

Increased tension growing out of uncertainty over the outcome of the Korean truce talks strengthened prices paid for gold in the "free" market. According to Pick's world currency report, the following prices, per fine ounce, prevailed in leading trading centers at the end of July and August:

	Coins		Bars (12.5 kg.)	
	July 30	Aug. 30	July 30	Aug. 30
New York, transit	.....	.....	$40.50	$40.35
Manila	$48.00	$49.00	39.75	42.10
Hong Kong	49.00	49.00	43.50	43.65
Bombay	57.00	56.50	49.00	49.50
Tangier	50.75	51.50	40.25	40.45
Beyrouth	49.25	49.50	40.25	40.40
Paris	55.00	56.50	42.25	41.90
Buenos Aires	50.00	51.00	43.50	44.00

(Continued on page 100)

Major Metals

U. S. DAILY AND AVERAGE PRICES

Aug. 1951	Electrolytic Copper (a) Domestic	(b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc East St. Louis	Aug. 1951
1	24.200	27.425	103.000	17.000	16.800	17.500	1
2	24.200	27.425	103.000	17.000	16.800	17.500	2
3	24.200	27.425	103.000	17.000	16.800	17.500	3
4	No Market	27.425	103.000	17.000	16.800	17.500	4
6	24.200	27.425	103.000	17.000	16.800	17.500	6
7	24.200	27.425	103.000	17.000	16.800	17.500	7
8	24.200	27.425	103.000	17.000	16.800	17.500	8
9	24.200	27.425	103.000	17.000	16.800	17.500	9
10	24.200	27.425	103.000	17.000	16.800	17.500	10
11	No Market	27.425	103.000	17.000	16.800	17.500	11
13	24.200	27.425	103.000	17.000	16.800	17.500	13
14	24.200	27.425	103.000	17.000	16.800	17.500	14
15	24.200	27.425	103.000	17.000	16.800	17.500	15
16	24.200	27.425	103.000	17.000	16.800	17.500	16
17	24.200	27.425	103.000	17.000	16.800	17.500	17
18	No Market	27.425	103.000	17.000	16.800	17.500	18
20	24.200	27.425	103.000	17.000	16.800	17.500	20
21	24.200	27.425	103.000	17.000	16.800	17.500	21
22	24.200	27.425	103.000	17.000	16.800	17.500	22
23	24.200	27.425	103.000	17.000	16.800	17.500	23
24	24.200	27.425	103.000	17.000	16.800	17.500	24
25	No Market	27.425	103.000	17.000	16.800	17.500	25
27	24.200	27.425	103.000	17.000	16.800	17.500	27
28	24.200	27.425	103.000	17.000	16.800	17.500	28
29	24.200	27.425	103.000	17.000	16.800	17.500	29
30	24.200	27.425	103.000	17.000	16.800	17.500	30
31	24.200	27.425	103.000	17.000	16.800	17.500	31
	AVERAGES FOR MONTH						
Aug.	24.200	27.425	103.000	17.000	16.800	17.500	Aug.
	AVERAGES FOR WEEK						
Aug.							Aug.
1	24.200	27.425	105.500	17.000	16.800	17.500	1
8	24.200	27.425	103.000	17.000	16.800	17.500	8
15	24.200	27.425	103.000	17.000	16.800	17.500	15
22	24.200	27.425	103.000	17.000	16.800	17.500	22
29	24.200	27.425	103.000	17.000	16.800	17.500	29
	CALENDAR WEEK AVERAGES						
Aug.							
4	24.200	27.425	104.000	17.000	16.800	17.500	
11	24.200	27.425	103.000	17.000	16.800	17.500	
18	24.200	27.425	103.000	17.000	16.800	17.500	
25	24.200	27.425	103.000	17.000	16.800	17.500	

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Aug. 1951	Sterling Exchange "Checks"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
1	279.8750	90.160	78.500d.	248s.	$35.00
2	279.9375	90.160	78.500d.	248s.	35.00
3	279.9375	90.160	78.500d.	248s.	35.00
4	(a)	(a)	(a)	(a)	35.00
6	279.9375	90.160	Holiday	Holiday	35.00
7	279.9375	90.160	78.500d.	248s.	35.00
8	279.9375	90.160	78.500d.	248s.	35.00
9	279.8750	90.160	78.500d.	248s.	35.00
10	279.8750	90.160	78.500d.	248s.	35.00
11	(a)	(a)	(a)	(a)	35.00
13	279.8750	90.160	78.500d.	248s.	35.00
14	279.8750	90.160	78.500d.	248s.	35.00
15	279.8750	90.160	78.500d.	248s.	35.00
16	279.9375	90.160	78.500d.	248s.	35.00
17	279.9375	90.160	78.500d.	248s.	35.00
18	(a)	(a)	(a)	(a)	35.00
20	279.9375	90.160	78.500d.	248s.	35.00
21	279.9375	90.160	78.500d.	248s.	35.00
22	279.9375	90.160	78.500d.	248s.	35.00
23	279.9375	90.160	78.500d.	248s.	35.00
24	279.9375	90.160	78.500d.	248s.	35.00
25	(a)	(a)	(a)	(a)	35.00
27	279.9375	90.160	78.500d.	248s.	35.00
28	279.9375	90.160	78.500d.	248s.	35.00
29	279.9375	90.160	78.500d.	248s.	35.00
30	279.9375	90.160	78.500d.	248s.	35.00
31	279.9375	90.160	78.500d.	248s.	35.00
	AVERAGES FOR MONTH				
Aug.	279.921	90.160	78.500d.	—	35.00
	AVERAGES FOR WEEK				
Aug.					
1	279.9000	90.160	—	—	—
8	279.9375	90.160	—	—	—
15	279.8750	90.160	—	—	—
22	279.9375	90.160	—	—	—
29	279.9375	90.160	—	—	—

Calendar week averages, New York Silver: Aug. 4th, 90.160; 11th, 90.160; 18th, 90.160; 25th, 90.160.

(a) No market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.500c. per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c. to 0.15c. per pound.

Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West, effective Jan. 1, 1951, commanded a premium of 1.35c. per pound over the current market for Prime Western; Special High Grade 1.50c.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points.

(c) The daily New York silver quotation reported by Handy & Harman is for silver contained in ores and other unrefined silver-bearing materials, in cents and fractions of a cent per troy ounce. It is determined by Handy & Harman on the basis of actual sales of bar silver .999 fine in amounts of 50,000 ounces or more for nearby delivery at New York, and is usually one-quarter cent below the price paid for such bar silver, this deduction being the allowance for carrying, delivering and marketing. In addition to foreign silver, the quotations also apply to domestic and Treasury silver if such silver enters into the New York market.

The Treasury's purchase price of newly mined domestic silver is 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver is pence per troy ounce, basis .999 fine.

(d) U.S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Behind the By-Lines . . .

» **Unconcerned** by the weight of the heavy pipe he seems to be supporting in the above picture, G. L. Augustadt, ventilation engineer for Magma Copper Co., Superior, Ariz., feels pretty good about what that pipe does for him and for the mine.

We heard about it from Associate Editor Al Knoerr, who was in Superior a while ago. "Did you know," Spike Gardner, assistant manager, asked him, "that Augie gained another degree since you were here last?"

"No," said Al, "That's fine. What university did he get it from? Arizona?"

"Oh, no," said Spike. "Right here. I mean he cut another degree off the mine cooling water by painting the water pipes and cooling tower with aluminum paint to reflect heat. It dropped the average temperature a whole degree."

From which you might deduce: that Magma, if left alone, is a hot mine; that every degree cut off the temperature is important; that the company goes to a lot of trouble to keep the mine cooled down. No matter if your own problem is ice in the manways, you'll still be interested in Mr. Augustadt's account of Magma's extensive and ingenious cooling system. It begins on p. 72.

» **"Phosphorous Phosphorous Phosphorous!!!"**—That's the way an interesting little item was headlined in a recent mineral bulletin which came across our desk. To which we say "No, No, No!!!" You don't spell it with an "ous". It's "Phosphorus, Phosphorus, Phosphorus!!!" At least that's what Webster says, and he doesn't even give you a choice if you mean the noun phosphorus. It's surprising how often authors, engineers, news correspondents and even some of the editors around our shop will slip up on this—that is until our alert copy editor catches the error. And while we are speaking about misspelled words, here's another one that might trip you up: "Liquefy." It's spelled with an "e" instead of an "i".

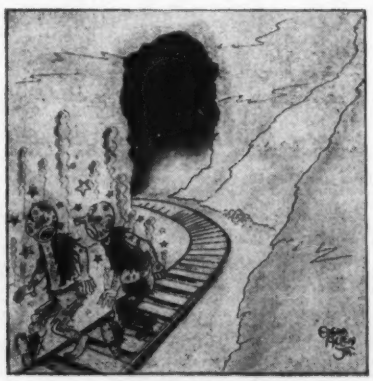
» **Did you know** that there are three types of intracratonic basins classified by Kay as exogeosynclines, autogeosynclines, and zeugogeosynclines? Also that the exogeosyncline is transitional between the orthogeosynclinal belt and the craton? If you don't, then you're not up on your stratigraphy. We found all of these things out by reading a very interesting textbook on stratigraphy and sedimentation by Krumbein and Sloss (See book review p. 153.) And while we have nothing against the authors and their fine book, we can't help admitting that we were bogged down at times in the chapter on "Tectonic Framework and Sedimentation." It seems that tectonicists traditionally prefer to express several descriptive sentences by one massive linkage of a dozen horrendous syllables—like "an intra-eugeosynclinal geanticline."

Studying this text is contagious. So tonight when we get home and the wife and kiddies ask us what kind of a day we had, we'll say, "Oh, rather thermo-occidentarlialmerganthalerish."

And they will, of course, know at once that it was one of those hot sticky days, with a lot of dirt blowing in the window from over in New Jersey, and that the printer gave us a bad time because we missed the deadline again.

» **Geologists** can also simplify things, we must admit. As they do at Consolidated Beattie, up in Quebec. Turn to p. 108, Operating Ideas section, and see for yourself.

» **You can stop worrying** about your mining community becoming a ghost town. Old mining camps don't fade away any more; they get broken up into little pieces and sold. That's what's happening to Dawson, N. M., once the site of Phelps-Dodge's coal operations. A Phoenix man has bought the town and will sell you all or any part of it from a pencil sharpener to a hospital.



"Sure I said 'fast delays'—but not that fast!"

ENGINEERING AND MINING JOURNAL
SEPTEMBER, 1951

Dual Prices Are Nonsense

THE PRESENT SITUATION in mineral prices, domestic vs. international, just doesn't make good sense.

For our own part, we have great doubt that the system of price, production, and supply controls in which we are enmeshed is worth the candle. If controls were resolutely administered, regardless of politically sacrosanct pressure groups, and if the surplus of purchasing power created by Government deficit spending were wiped out by effective anti-inflationary taxation, the results might justify the cost. But we are less worried over the prospect of a temporary but self-correcting "inflationary gap" in a free economy than we are over what amounts to inflation by decree, with inadequate measures being taken to eliminate the scarcities which are used to justify controls.

However, if the majority elects to emulate the socialistic trends of a tired Old World by continuing to shackle the national economy with controls, then at least a better job can be done in making raw-material prices more equitable. The domestic producer has a sound basis for objecting to a system that pays premium prices for imports, particularly in cases where the countries receiving the premium prices are also receiving assistance out of the pockets of American producers.

We have a supply problem and we know that an adequate price will bring out the minerals. The people who are fiddling with mineral price controls ought to be sure that what they have to offer will do the same job. If we must have price controls and it is necessary to pay premium prices for foreign supplies, then the domestic producers should be offered flat subsidies equivalent to the premiums paid for needed foreign material.

A Time for Participation

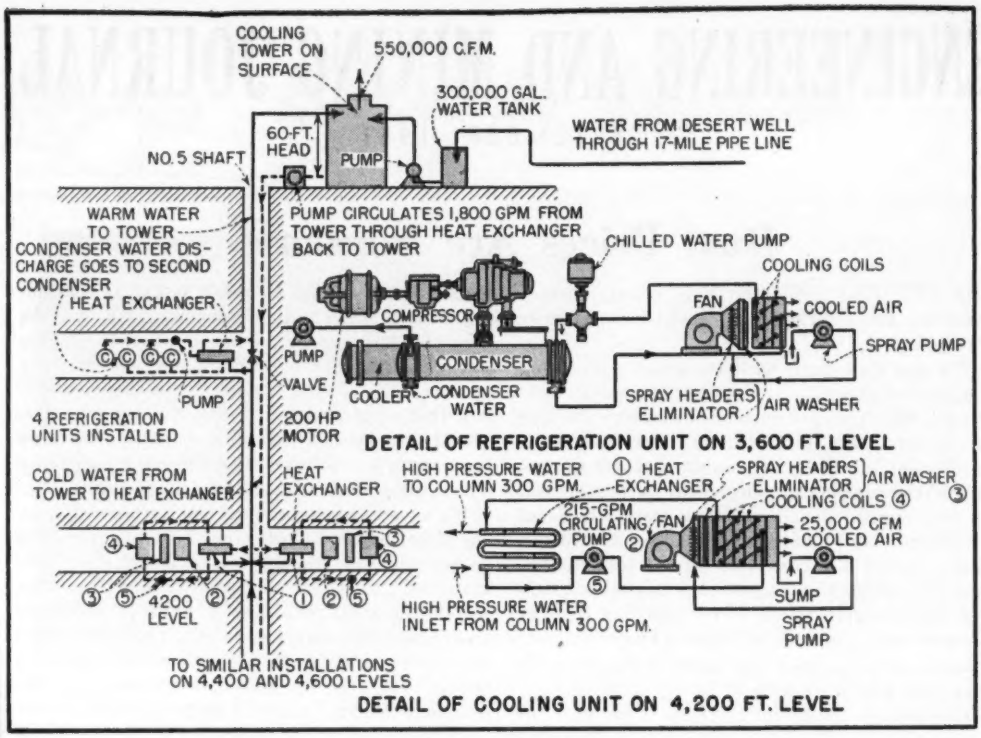
FEELINGS OF DOUBT, frustration or disappointment over the reorganization of the defense minerals setup in Washington should not be permitted to foster a disposition to abandon Washington to the politicians and economists.

The mining industry has a duty to the public to produce the minerals needed in adequate amounts and efficiently. The industry has a duty to itself, severally and collectively, to participate vigorously in mineral public affairs so that public policy will be realistically guided and that no vacuum is left to be filled by ambitious but impractical tax-spending theorists. The latter, if uncontested, will inevitably use the great power of the Federal Government to socialize the mineral industries.

A prominent member of the present defense administration, discussing the tendency of the business community to desert Washington as soon as shooting stops, recently gave a meaningful twofold warning. "First," he said, "Do not forget that what Washington does will continue to have a profound effect on business. Second, remember that no vacuum left down here by vacating industrialists will remain a vacuum. There are plenty of individuals ready to accept these jobs. If they obtain them by default on the part of the business community, the latter will have only itself to blame if these administrators turn out to be impractical, socialistic, or even worse."

On the credit side of the ledger is the circumstance that the new head of the Defense Materials Procurement Agency, Jess Larson, has the reputation of being a straightforward, sincere administrator. He deserves the wholehearted cooperation of the mining industry, including the furnishing of competent personnel for his key posts. Moreover, the unification of mineral procurement and development functions under a single command with real power to act may prove to be a great advantage over the previous arrangement, which had too many fingers in every pie.

Therefore, participate, don't abdicate, and hope for the best. If you can't participate directly, do so through your state or regional mining association, through the American Mining Congress, or through your members of Congress. But, because the ways of Washington often seem hopelessly confused, don't abandon your stake in your Government to whomsoever may choose to fill the vacuum left by your default.



HOW THE SYSTEM WORKS: Water cooled by evaporation in the tower goes down the shaft through high-pressure lines where it takes up heat from low-pressure water system through heat exchangers. Chilled low-pressure water is then used to cool mine air: (1) by circulating directly in banks of cooling coils through which mine air is forced before it is blown to hot working faces; or (2) by circulating through the condensers of Carrier refrigerating machines which in turn produce chilled water to be circulated through air-cooling coils. Details of both the direct cooling coils, and the refrigerating system are shown schematically above.

How Magma's New Cooling Plant Combats the Mine Heat Problem

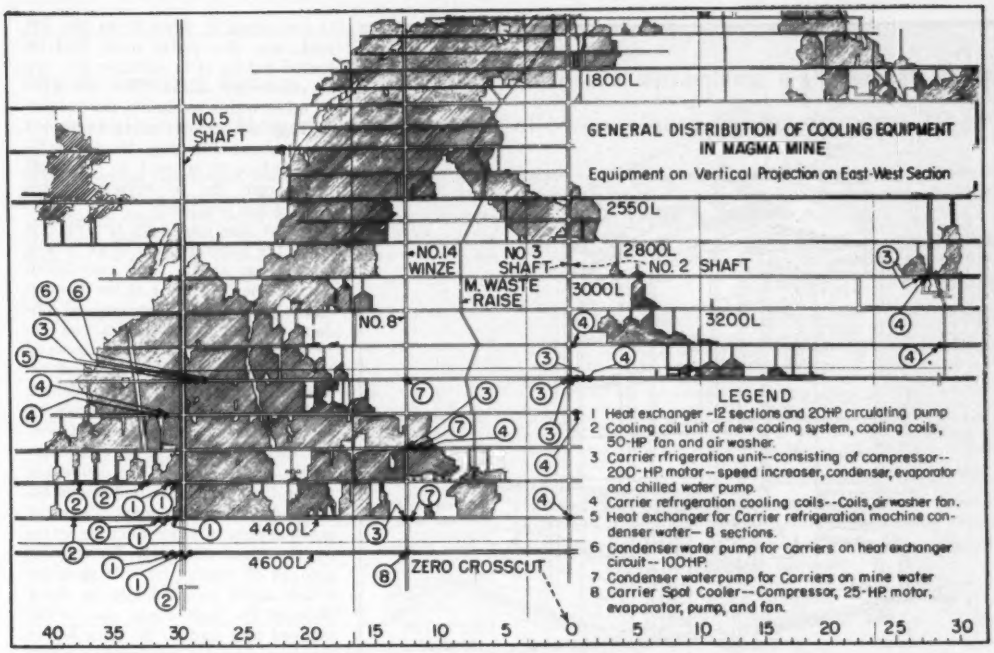
GARVIN L. AUGUSTADT,
Ventilation Engineer,
Magma Copper Co., Superior, Ariz.

MAGMA COPPER CO.'S new mine cooling system employing a cooling tower and underground heat exchangers was put into operation on Aug. 26, 1948. The unit was used at once to cool the site for a second installation on the 4,200 ft. level, and proved so effective that it reduced air temperatures from 94 deg. wet bulb[1] and 111 deg. dry bulb on Aug. 26, to 67 deg. wet bulb and 72 deg. dry bulb on Aug. 27. The second unit was put into operation on Sept. 4, 1948.

This method of using a cooling tower on the surface was first successfully employed by A. S. Richardson at Butte, Montana. Chief difference in the two cooling systems is that high pressure cooling coils receive the water direct from the cooling tower at Butte, while at Magma the cold water from the tower is circulated through heat exchangers underground in which high-pressure water from the tower takes up heat from water in a low-pressure circuit with low-pressure cooling coils.

The cooling tower on the surface and heat exchangers underground on the 4,200, 4,400 and 4,600 ft. levels are in closed circuit. A centrifugal pump rated at 1,800 gpm at a 610-ft. head powered by a 500-hp. motor circulates water through two pipe lines, connected to the cooling tower and the heat exchangers. The power used to circulate the water is that which is required to offset the friction losses in the pipe lines and heat exchangers, plus a small static head of about 60 ft.—the difference in elevation

[1] All temperatures given in this article are in degrees Fahrenheit.


GENERAL DISTRIBUTION OF COOLING EQUIPMENT IN MAGMA MINE
Equipment on Vertical Projection on East-West Section
1800L
NO. 5 SHAFT
2550L
NO. 14 WINZE
NO 3 SHAFT
2800L
NO. 2 SHAFT
M. WASTE RAISE
3000L
NO. 8
3200L
4400L
4600L
ZERO CROSSCUT
LEGEND
1 Heat exchanger -12 sections and 20HP circulating pump
2 Cooling coil unit of new cooling system, cooling coils, 50-HP fan and air washer.
3 Carrier rfrigeration unit--consisting of compressor--200-HP motor--speed increaser, condenser, evaporator and chilled water pump.
4 Carrier refrigeration cooling coils--Coils, air washer fan.
5 Heat exchanger for Carrier refrigeration machine condenser water--8 sections.
6 Condenser water pump for Carriers on heat exchanger circuit--100HP.
7 Condenser water pump for Carriers on mine water
8 Carrier Spot Cooler--Compressor, 25-HP motor, evaporator, pump, and fan.
40 35 30 25 20 15 10 5 0 5 10 15 20 25 30

HOW THE COOLING EQUIPMENT IS DISTRIBUTED. Note that high-pressure equipment (pipes and heat exchangers) are confined near the shaft area. Short high-pressure lines lower installation and operating costs.

between the top of the water in the cooling tower pump and the water distributing system near the top of the tower (see illustration p. 72). Two pipe lines were installed in the ventilation compartment of No. 5 shaft and extend below the 4,800 ft. level. This required many thousand feet of 10 and 12-in. pipe, all of which was specially fabricated to meet requirements of the installation. The pipe in both columns at the elevation of the lower levels has a wall thickness of 1 in., designed for a working pressure of 2,500 psi. Heat exchangers, valves, and pipe fittings in the cooling installation are designed for a working pressure of 2,500 psi.

A well about 640 ft. deep was drilled to supply water for the new cooling system. Water is pumped from a depth of 610 ft. by a deep-well pump, into a tank at the well. From here it is then pumped to a 300,000-gal. storage tank at the cooling tower through a 6-in. pipe line, approximately 17 mi. long.

Cool water from the tower is heated by warm water in the underground heat exchangers which are connected to cooling coils on the lower levels of the mine. Mine ventilation air is cooled as it passes through the cooling coils, its heat being taken up by the water which is circulated through the coils and heat exchangers in a low-pressure circuit. The cool air from the cooling coils is then delivered to the working places through ventilation pipes or ventilation drifts, and a percentage of this air is again returned to the cooling coils where it is again washed and cooled.

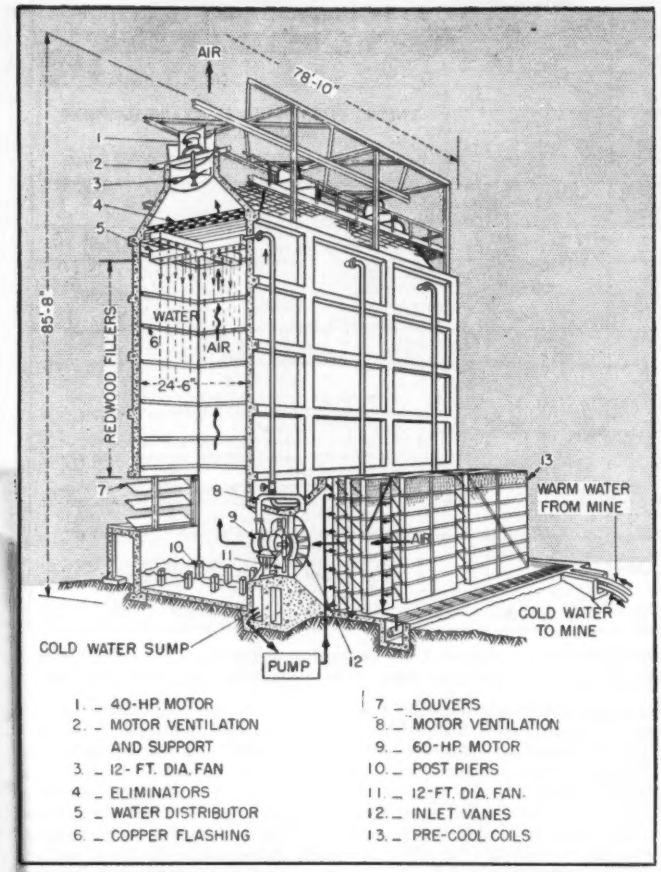
High surface temperatures, coupled with higher than average rock temperatures underground in the Magma mine, present a difficult ventilation problem. Small, deep shafts limit the quantity of ventilation air available in a mine where large volumes of cool air are required to cool working places. Air requirements have been met by use of some return air from the stopes, together with fresh air from the shaft, all of which is washed and cooled.

Coil Corrosion a Problem

Cooling coils have been in use in the Magma mine since August, 1937, when the first Carrier refrigeration machine was installed. The period of efficient operation of the cooling coils was found to be one to two years. Corrosion of the copper fin and tube cooling coil, due to very fine dust collecting on the wet surfaces of the coil, as well as from gases from blasting, progresses to the point that the copper fins become brittle and fall off and the copper tubes begin to leak.

Excessive cost of copper cooling coils, designed for a water pressure of 2,500 psi, considering replacement of these coils because of corrosion, prohibited their use. Therefore, W. P. Goss, vice president and general manager, and C. B. Foraker, acting mine superintendent, of Magma Copper Co., decided to modify the cooling system used at Butte by the use of water-to-water heat exchangers instead of high-pressure coils. It should not be necessary to install new heat exchangers, because the water in the cooling tower-exchanger circuit is treated to inhibit corrosion and scale. Excessive concentration of solids is also prevented by regulating the amount of water continuously blown off to remove solids, caused by evaporation in the cooling tower. The low-pressure cooling coil-exchanger circuit is filled only once with clear water, after which this same water is circulated in a closed circuit where corrosion and scale is negligible.

High-pressure water circuits at approximately 2,500 psi need be installed only a short distance from the shaft to a heat exchanger sta-



LIST OF EQUIPMENT installed in cooling tower is given in Table VI on opposite page. Tables VII and VIII, page 75, give typical operating data.

tion. The cold-water low-pressure circuit at approximately 70 psi can be installed to cooling coil stations several thousand feet from the shaft, in the stoping area to be cooled. This eliminates the cost and the hazard of long high-pressure water lines from the shaft to high-pressure coils in stoping areas. For cooling working places remote from the shaft, it is not necessary to make any new high-pressure piping installations. Long low-pressure lines are installed to low-pressure cooling coils near the area to be cooled.

Reasons for New System

It was not possible to cool the working places sufficiently, even with a very elaborate ventilation system operating with seven Carrier refrigeration machines. The excessive heat, due to the high rock temperature, required expansion of the mine cooling system. Rock temperature increases 26 deg. between the 2,550 ft. level where the temperature is 129 deg., and the 4,600 ft. level where the rock temperature is 155 deg., indicating a geothermal gradient of approximately 1.27 deg. per 100 ft. of depth.

Further expansion of mine cooling, by installation of additional refrigeration machines underground, was not possible economically because of condenser-water requirements of these units. A refrigeration unit requires one to two gpm of condenser water at near 80 deg. per horsepower of compressor motor. Each of the seven Carrier refrigeration machines underground has a 200-hp. compressor motor, a total of 1,400 hp., indicating a condenser water requirement of 1,400 to 2,800 gpm. Total mine water is approximately 400 gpm, all of which is hot when it flows from the hot rock, and this water must first be cooled before it is suitable for use as condenser water. This 400 gpm of mine water available for refrigeration condenser water is cooled from about 130 deg. to about 93 deg. before it is used to carry off heat from the condensers of refrigeration machines.

Water was cooled by spraying it down the lower section of an intake ventilation shaft, thus sacrificing part of the intake air at the eastern end of the mine. Hot return condenser water from the Carrier refrigeration machines was sprayed into the exhaust mine air and reused for refrigeration condenser water. Re-use of condenser water, cooled by evaporation, raised concentration of solids in the condenser water to the point that condenser water lines and the condensers became obstructed by scale. Thus the small supply of hot condenser water underground definitely limited the amount of cooling by refrigeration which could economically be done, because the heat could not be destroyed and had to be transferred to air and water leaving the mine. The smaller the quantity of condenser water, the larger will be its temperature rise; and temperature of the condensing refrigerant also rises. This increases the head pressure necessary to condense the refrigerant, and the required horsepower per ton of refrigeration.

Installation work for the first two Carrier refrigeration units was completed in August, 1937, and these machines were furnished with the entire quantity of underground water at a temperature of about 90 deg. These units provided satisfactory cooling for the west stopes on the 3,400 and 3,600 ft. levels. As the number of refrigeration machines was increased, the amount of cooling provided by each machine decreased and the overall cost per refrigeration ton increased.

Construction of the new cooling system was ordered when Magma officials decided to enlarge mining operation by bringing stopes into production in the east orebody below the 3,200 ft. level. To step up production in both east and west orebodies simultaneously, it was necessary to increase underground cooling capacity. Development and exploration work had been discontinued in the east end of the mine on the 3,400, 3,600, 3,800, and 4,000 ft. levels, during the period 1939 to 1942, and these drifts were sealed off to prevent return hot air from heating the west section of

The following tables contain comprehensive operating and design data pertaining to Magma's cooling installation. (More tables on page 79.)

TABLE I. Typical temperature readings in development headings taken before the new cooling system was installed. (Although stopes were being cooled by Carrier units, development headings were not. These readings revealed the need for an expanded cooling system to take care of development headings.)

Location	Date		Wet	Dry	R.H.
3800 E. Drift	July 1942	Air from vent. tube	88	108	45%
		Air at face of drift	95	106	66%
		Return air from face	110	114	88%
4000 E. Drift	Aug. 1940	Air from vent. tube	89	103	58%
		Air at face of drift	91	101	68%
		Return air from face	104	105	97%
4200 W. Drift	Sept. 1940	Air from vent. tube	93	107	57%
W. of 14 X.C.		Air at face of drift	96	105	66%
		Return air from face	91	109	64%
4400 W. Footwall	Sept. 1940	Air from vent. tube	90	108	49%
Drift—E. of No. 5 shaft		Air at face of drift	92	110	50%
Shaft X.C.N.		Return air from face	100	105	84%
4600 W. Drift	July 1940	Air from vent. tube	94	110	55%
W. of 14 X.C.		Air at face of drift	95	110	60%
		Return air from face	110	114	88%
4600 W. Drift	July 1942	Air from vent. tube	88	100	62%
E. of N. 5 shaft		Air at face of drift	90	98	73%
X.C.N.		Return air from face	96	106	69%
4600 W. Drift	Nov. 1942	Air from vent. tube	91	106	56%
W. of No. 5 shaft		Air at face of drift	93	107	59%
X.C.N.		Return air from face	95	106	66%

TABLE II.—After new cooling system was installed. Note how much cooler the development headings on the 4,600 ft. level were as compared with those on the 4,600 ft. level shown in Table I above.

Location	Date		Wet	Dry	R.H.
4600 Footwall[1] Drift	Sept. 1950	Air from vent. tube	76	95	42%
East of No. 5 X.C.N.		Air at face of drift	77	96	42%
4600 W. Footwall[2]	Feb. 26, 1951	Air from vent. tube	79	100	44%
E. of 14 X.C.S.		Air at face of drift	81	101	38%
4600 W. Drift[3]	May 3,,1951	Air from vent. tube	67	78	56%
W. of No. 5 Shaft X.C.N.		Air at face of drift	77	86	66%

[1] Approximately 1,000 ft. from cooling coils.

[2] Approximately 2,000 ft. from cooling coils. At time of this reading water leaving the cooling tower was 47 deg. It gained 2 deg. going down the No. 5 shaft and entered the heat exchangers on the 4,600 ft. level at 49 deg. Air from the downcast No. 5 shaft entered the cooling coils on the 4,600 ft. level at 81 deg. wet bulb and 87 deg. dry bulb. Air leaving these coils was saturated at 58 deg. It traveled 2,000 ft. on the 4,600 ft. level where rock temp. is 155 deg. Air reaching face was 79 deg. wet bulb.

[3] Other data at time of this reading: Air from shaft entering cooling coils, 80.5 deg. wet bulb, 85 deg. dry bulb, r.h. 82%; air from coils through vent. tube, 59 deg. wet bulb, 59 deg. dry bulb, r.h. 100%; temp. cooling tower water on surface, 50 deg.; temp. high-pressure water entering 4,600 exchanger, 52 deg.; temp. of high-pressure water leaving exchanger, 60.5 deg.; temp. low-pressure water to cooling coils, 53 deg.; temp. low-pressure water from cooling coils to exchanger, 70 deg. Working place was within a few hundred feet of cooling coils.

TABLE III. Comparison of temperatures on the 3,400 ft. level before and after the new cooling tower was installed.

Location	Date		Wet	Dry	R.H.
3,400 E. Drift	Aug. 1940,	Air from vent. tube	85	115	29%
E. 18 X.C.	before tower	Air at drift face	90	112	42%
	was installed	Air returning from face	95	110	57%

(Note: This heading 1,350 ft. east of Zero X.C. was advanced with difficulty due to heat. The drive on the east extension of the vein was stopped at the East 30 X.C. position. The drift was bratticed off to shut off the hot return air. The 3,400 East Drift was reopened in 1949, and cooling coils were installed at East 28 X.C. position.

Now note below how much cooler the temperatures were in the two following positions (2,700 and 6,350 ft. east, respectively, of the Zero X.C.) after the cooling coils had been installed.

Location	Date		Wet	Dry	R.H.
3,400 E. Drift	Feb. 1950	Air from vent. tube	64	68	80%
E. 34X.C.	after tower	Air at drift face	72	78	75%
	was installed				
3,400 E. Drift	April 1951	Air from vent. tube	76	100	33%
E. 62 X.C.		Air at drift face	85	99	56%

TABLE IV. Showing increase in air tempeature as it travels through a 24-in. diameter steel ventilation pipe, 2,800 ft. long on the 3,400 ft. level.

Location	Date		Wet	Dry	R.H
3,400 E.	Apr. 9, 1951	Air entering cooling coils	84	92	72%
		Air leaving cooling coils entering vent. pipe	62	62	100%
3,400 E. Drift Face at E. 62 X.C.	Apr. 9, 1951	Air from vent pipe	76	100	30%

Important: This shows a gain of 14 deg. wet bulb. The total heat content of air and water vapor depends upon wet-bulb temperature alone; therefore the 14-deg. rise in the wet-bulb temperature is the total heat gain of the air. The 32-deg. rise in dry-bulb temperature has little effect upon the working conditions at the face of the drift. Total heat content of a mixture of air and water vapor changes only slightly for any wet-bulb temperature as the dry-bulb temperature changes in the range ordinarily encountered, as is shown in the Table V prepared for air having various dry-bulb temperatures, but having the same wet-bulb temperature.

TABLE V showing that total heat content of air depends essentially on the wet-bulb temperature. Note below that a constant wet-bulb temperature means a virtually unchanged total heat content.

Wet-Bulb Temp.	Dry Bulb Temp.	Dew Point Temp.	Relative Humidity	Btu per Lb. of Dry Air Sensible Heat	Latent Heat	Total Heat
65	65	65	100	15.69	13.69	29.65
65	75	57.9	58	18.11	11.57	29.68
65	85	53.2	33	20.53	9.15	29.68
65	95	45.1	18	22.95	6.76	29.71

In this table the sensible heat of the liquid and the sensible heat of super-heated vapor were neglected; however, the numerical error is very small. Thus, in practical air conditioning work, in figuring total heat removed during a cooling process, or total heat added during a heating process, only the initial and the final wet-bulb temperatures need be known. In the table, notice that saturated air (for which the dry-bulb, wet-bulb, and dew-point temperatures are all equal) has the same total heat content as unsaturated air of any percentage humidity. The total heat content of the air does not change, even though its proportions of sensible and latent heat do change as the percentage humidity changes.

TABLE VI. List of equipment in cooling tower.

PUMPS FOR PRECOOLER COILS.

Four deep-well, turbine-type pumps rated at 600 gpm, against 85-ft. head. Each direct connected with 15-hp, 1,450-rpm, 25 cycle, vertical motor.

FAN MOTORS.

Three 60-hp., 25-cycle, 375-rpm motors for precooler fans.

Three 40-hp., 25-cycle, 375-rpm, vertically mounted motors for top fans.

PROPELLER FANS.

Three 12-ft. diameter, four-blade Monel fans, variable-pitch blades for precooler use with three 12-ft. inlet guide-vane sections. Fans, rated at 540,000 cfm at 3,000-ft. elevation against 1.08-in. wg.

Three 12-ft. diameter, four-blade Monel fans, variable-pitch blades for top fans with three fan supports with motor hoods; three 12-ft. diameter diffuser cones 4 ft. high. Fans rated at 560,000 cfm for air at 85 deg. at 3,000 ft. elevation against 0.615-in. wg.

PRECOOLER COILS.

One hundred twenty-six coils with removable headers. Total weight 215,000 lb. approx.

Seven coils high in each bank.

Three coil banks, 18 tubes deep in direction of air flow.

Two rows of coil banks per tower cell.

Forty-two coils for each tower cell.

SPECIFICATIONS FOR A COIL:

Size, 10 ft. 8 in. long, 35 in. high, 14⅝ in. deep across tubes.

Net face area, 25.6 sq.ft.

No. tubes, 120 total, six rows deep by 20 tubes per row.

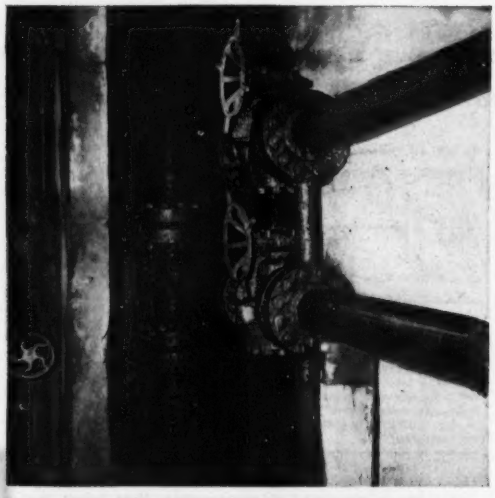
Tubes, copper, ⅝-in. O.D. with 0.035-in. wall, 10 ft. long.

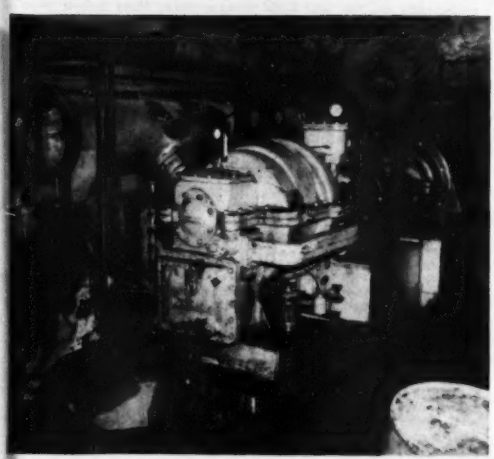
Tube fins, copper, seven per in., 0.008 in. thick.

Tube sheets, cast iron.

Headers, cast iron.

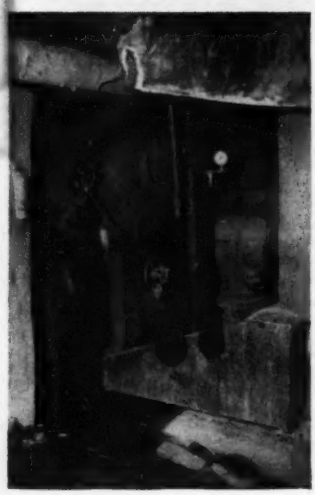
Design pressure, 125 psi.

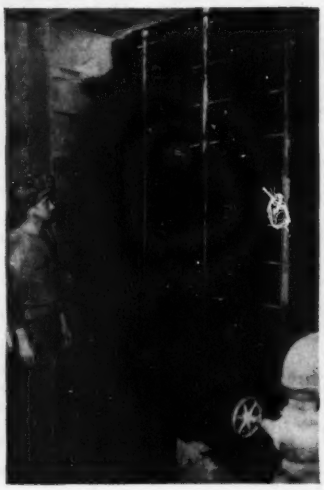




The Author Explains the System

G. L. Augustadt, ventilation engineer at Magma, points out important details of plant. High-pressure water from cooling tower comes down No. 5 shaft (upper left) and goes to heat exchangers on 4,400 ft. level (upper right) where cool water picks up heat from low-pressure water systems. Chilled low-pressure water is then used to cool condensers of Carrier refrigeration units (left), which in turn produce cold water for cooling coils; or chilled low-pressure water goes directly to cooling coils in a cooling and washing station shown below. Fan (lower left) blows ventilation air through spray washer (lower center) and then through fin-covered tubes containing chilled water (lower right). Cold air then goes to face in ventilation pipe. Complete operating data for a unit such as this is given in Tables IX and X. Heat exchanger data appears in Table VIII.





the mine. Four Carrier refrigeration plants were moved from the west section of the mine to a new location to provide the cooling necessary for the stoping, development, and exploration now in progress in the east section on the 3,400, 3,600, and 3,800 ft. levels. Five complete new cooling units, connected to the cooling tower, replaced the Carrier units and are providing satisfactory cooling for development and stoping operations on the west orebody. A sixth cooling coil will be completed when stoping operations begin on the west 4,600 ft. level.

Table I lists temperatures typical of working conditions in headings on the lower levels showing why cooled air was necessary for development as well as for the stopes. Prior to installation of the new cooling system, Carrier refrigeration machines were installed to cool air for the stopes, after the completion of development work. The new cooling system, in conjunction with the Carrier units, now provides sufficient cooling capacity to supply cooled air for both development work in progress and stoping operations.

Table II, page 75, shows how much lower development-heading temperatures were after the new cooling system had been installed on the 4,600 ft. level. The same coil used for development headings was later used to cool stopes. At present there are two complete cooling installations supplying cool air to the 4,200 and 4,400 ft. levels.

Table II also reveals how effective the new cooling system was on the 3,400 ft. level.

How Cooling Is Checked

A complete set of wet and dry-bulb temperatures is taken at 14-day intervals throughout the mine. Average number of copper stopes worked in 1950 was 54. Average temperature for these stopes was 80.5 deg. wet bulb, and 86.7 deg. dry bulb.

Insulation Is Important

Chilled water from the 3,600 ft. level cooling plant is first circulated through coils on the 3,400 ft. level at zero cross-cut to cool air for 3,400 east stopes, before it enters the coils at east 28 cross-cut position, to cool air for the east drift heading. The two sets of coils are piped in series and the chilled water travels about 2,850 ft. before entering the second set of coils, making a total travel distance of about 5,700 ft. before the water re-enters the cooling plant where it is again cooled and returned. A double layer of ½-in. insulation was put on the 4-in. pipe line carrying chilled water to the coils. Joints of the second layer of insulation do not overlay the joints of the first layer. Thus an anti-sweat insulation is produced. This is covered with a waterproof jacket of felt paper to prevent absorption of water externally. As a result, temperature of chilled water traveling to the cooling coils increases only 1 deg. This chilled water is then circulated through two banks of coils, counterflow to the flow of air through these coils. There are three coils in each bank, and each coil has a net face area of 17.1 sq. ft. and is eight tube rows deep. This large heat transfer surface effects a 4-deg. approach between the temperature of air leaving the coils and temperature of chilled water entering the coils. A steel ventilation pipe, 24-in. in diameter, weighing 24.5 lb. per ft., is connected directly to the cooling coil station, and cool air is conveyed more than 2,800 ft. through this pipe to the drift face which is being advanced. (See Table IV on p. 75 showing temperature increase of air traveling through the 2,800-ft. pipe.)

The Cooling Tower

Magma's cooling tower (see p. 74) consists of three cells separated by concrete walls. Each cell is filled with redwood decking. It can be operated independently, or shut down for cleaning and repairing while the other two are in operation. Valves between the basins of the cells and the cold water sump can be closed to isolate a basin from the sump. Likewise valve controls in the 12-in. risers feeding water to each cell can be closed to isolate a cell.

Concrete piers in the tower basins support the redwood filling and the water distributing system. The redwood structure is built with 4 x 4-in. posts and diagonals with 2 x 4-in. crossties. A filling section of double-batt decks on 18-in. vertical centers is supported on 1 x 4-in. boards across the posts. Water is distributed at the top of the redwood filling by sprinkler nozzles. A redwood eliminator section of 1 x 4-in. boards, which are offset vertically in direction of air flow, was constructed above the water flumes to prevent water entrained in the air stream from leaving the tower.

A venturi fan throat between the precooler coils and the tower structure provides a transition from a rectangular opening behind the coils to the circular opening of the fan.

Opposite the precoolers, the tower is equipped with a set of hinged louvers which are opened during winter months. When the precooler coils are shut down, air enters the tower through the opened louvers during winter operation of the tower. This saves about 70 hp. per cell. The tower is operated as a standard cooling tower when the precooler coil pumps and the lower fans are shut down.

Why Air Is Precooled

The first cooling tower with a precool coil arrangement was designed by A. S. Richardson for Anaconda Copper Co. The advantage of precooling air entering the tower is in obtaining lower temperature water from the tower. In a cooling tower, the temperature of the water is limited by the wet-bulb temperature of the air which enters the tower. It then becomes necessary to supply the tower with air at a lower wet-bulb temperature to obtain cooler water from the tower. This is accomplished in Magma's tower by using approximately 50% of the cold water from the tower, to cool the air before it enters. Three 15-hp. turbine-type pumps supply precooler coils with approximately 1,800 gpm of cold water from the sump. This cold water is circulated through the coils counterflow to the air which passes through the coils. Heat from the air is given off to the water and the warm water from the coils is returned to the top of the tower. A 12-ft. diameter fan in each of the three fan throats induces the flow of air through the coils. Each of these variable pitch, four-blade fans is powered by a 60-hp. motor. These fans deliver approximately 550,000 cfm (which has been drawn through three banks of coils and cooled with no change in moisture content) to the bottom of the tower. Precooled air is then drawn upward through the tower decking against a downward flow of approximately 3,600 gpm of water. The three fans at the tower which draw the air up through the decking are duplicates of the lower fans except that the top fans are powered by 40-hp. motors.

Copper flashing, set in the concrete tower walls, extends downward at 45 deg. and prevents water from

running down the inside walls.

Water from the storage tank is pumped to the top of the tower to allow it to cool before it enters the cold-water sump. Water from the well, after flowing approximately 17 miles through a pipe line which is exposed to the sun, enters the storage tank at near 120 deg. during the summer months. An electric switch on a float valve in the cold water sump regulates the amount of water from the storage tank which is pumped to the top of the tower to compensate for water lost by evaporation and water which is blown off.

The tower, precool coils, and pipes were painted with aluminum paint to reflect sun rays. This reduces the absorption of external heat into the system. The two insulated 12-in. pipe lines between the cooling tower and the entrance to the mine were also painted with aluminum paint.

Details of One Cooling Unit

Each of the six new underground cooling units is designed to cool 25,000 cfm of air from 95 deg. dry bulb and 90 deg. wet bulb to a final condition of 72 deg. saturated, when the coils are supplied with 215 gpm of water at 68.3 deg. from the heat exchangers. Heat exchangers are designed to cool 215 gpm of water, entering from the coils, from 89.2 deg. to 68.3 deg. when the exchangers are supplied with 250 gpm of water from the tower at 66 deg. Five heat exchangers which are now in operation are supplied with 1,680 gpm of cold water from the tower, which is approximately 336 gpm for each unit. A total circulation of 1,800 gpm of water from the tower will supply each of the six exchangers with approximately 300 gpm of high-pressure water when the sixth unit is in operation.

A fan rated at 25,000 cfm at 8 in. wg static pressure, direct connected to a 50-hp., 1,465-rpm motor, forces the air through an air washer to clean the air before it enters the cooling coils. Entrained water in the air from the sprays is impinged on the eliminator plates and flows with the spray water to a small sump. A centrifugal pump rated at 125 gpm at 45-ft. head, pumps water from the sump through 80 spray nozzles in the air washer. Washed air then passes through three banks of coils, where it is cooled by the chilled water from the heat exchanger. Each of the banks of coils is three coils high and eight tubes deep, which for three banks is 24 tubes deep in direction of air flow. There are 168 tubes, 84 in. long, in each coil.

A centrifugal pump rated at 215 gpm at 150-ft. head, powered by a 20-hp. motor, circulates the water in the low-pressure circuit between the exchanger and the coils.

The Heat Exchanger

High-pressure water within the tubes and low-pressure water on the outside of the tubes within the shell, each travel a distance of approximately 240 ft., counterflow to each other, to pass through the exchanger. Overall dimensions of an exchanger battery are approximately 60 ft. long, 3 ft. wide, and 6 ft. high. Exchanger sections are connected in series. Four rows of three-exchanger sections in length form a battery. It required 72 exchanger sections for the new cooling installation, 12 of which are welded together to make one battery for one coil installation. See Table VIII for heat-exchanger design details, and Table IX for operation data of a typical unit.

How the Tower Increased Refrigeration Capacity

The amount of cooling obtained from the Carrier refrigeration machines was limited by the small amount of condenser water available to carry heat away. For efficient operation, each of the seven Carrier plants require 200 gpm of condenser water at about 80 deg.

The seven Carrier plants were operated on a total mine water supply of only 400 gpm, by re-use of water which was cooled in spray ponds in the mine air exhaust system. Thus the machines operated at low efficiencies; and horsepower, maintenance, and repair cost per ton of refrigeration produced, was high.

In a refrigeration machine, heat added to the refrigerant in the evaporator, and during compression, cannot be destroyed. The heat must be transferred to the quantity of water available in the condenser. The compressor in the system must raise pressure of the refrigerant vapor to such a point that it can be liquefied at a temperature above that of the available condenser water. Head pressure to be maintained in the condenser is determined by the temperature at which the vapor is condensing, and required horsepower increases as head pressure increases. Temperature of the refrigerant liquid leaving the condenser is usually near the temperature at which the vapor is condensed. Refrigerating capacity is affected by the temperature of the refrigerant liquid, therefore it is desirable to maintain as low a condensing temperature as possible.

This condenser water problem was solved by using the return water from the heat exchangers of the new cooling system, to cool condenser water for four Carrier plants on the 3,600 ft. level. This was accomplished by installing an eight-section, water-to-water, heat exchanger connected to the return-water column of the new cooling system, and to a condenser water system. Now only three Carrier plants operate on the 400 gpm of mine water. A valve was installed between two tees in the return-water column of the new cooling system. This valve is closed and the return water from the heat exchangers on the 4,200, 4,400, and 4,600 ft. levels is passed through an exchanger on the 3,600 level.

The exchanger for cooling condenser water has eight sections connected in parallel to the high pressure water column, and in series to the low pressure condenser circuit. High-pressure water passes through 512 parallel tubes in the exchanger, where it cools the condenser water, before it returns to the tower. A pump with 100-hp. motor circulates condenser water, in closed circuit, through the exchanger and condensers of the refrigeration machines. Approximately 9,500 ft. of 6-in. pipe are used in this circuit which connects the Carrier machines to the new cooling system.

This new condenser water system increased the cooling capacity from 40 to 60 tons of refrigeration to 140 to 180 tons for each of the Carrier plants. Condensing head pressures on these machines were reduced from 30 to 35 psi to 6 to 10 psi.

(Note. A ton of refrigeration is equivalent to the latent heat of 1 ton of ice—288,000 Btu. Thus a refrigeration unit with a capacity of 1 ton of refrigeration would be capable of removing 200 Btu per min. or 288,000 Btu per 24 hr.)

The new condenser-water cooling system was put into operation on April 2, 1950. (See Table X which shows improved air-cooling performance of refrigeration units.)

Installation of the high-pressure pipe line in the No. 5 shaft was in itself a major engineering feat which will be described in a subsequent issue of *E&MJ*.

Performance and design tables continued, including cooling tower operating data, heat exchanger design, and cooling coil data.

TABLE VII. Operating data for cooling tower.

Summer operation of cooling tower: Precooler in operation.
The data taken at the cooling tower on June 16, 1950 at 2:45 P.M. is as follows:

	Wet Bulb	Temp.	Dry Bulb
Air to precool coils (Ambient atmosphere conditions)	56		94
Air leaving precool coils to enter tower	45.5		63
Water from tower to mine, approx. 1680 gpm		52	
Water from tower to precool coils approx. 1800 gpm		52	
Water from precool coils to tower approx. 1800 gpm		79	
Water from mine to tower approx. 1680 gpm		69	
Blended water (mine & coils) to top of tower, approx. 3,480 gpm		75	
Cubic feet of air per min. through tower		550,000 approx.	
Btu removed per min. in tower		667,730 approx.	
Btu removed per min. from mine by tower		237,900 approx.	
Horsepower consumed by tower		335 approx.	
Tons of refrigeration to mine per hp. by tower		3.5 approx.	

Note from the above data that the water leaving the tower at 52 deg. is 4 deg. below 56 deg. which is the wet-bulb temperature of the air. This was accomplished by cooling the air before it entered the tower.

For June, 1950, from the data recorded at the tower, the average temperature of air was 57.3 deg. wet bulb, and average temperature of water from the tower to the mine was 55.5 deg.

WINTER OPERATION OF COOLING TOWER. (Precool Unit Shut Down)

The data taken at the cooling tower Dec. 1, 1950 at 8:25 A.M. is as follows:

	Wet Bulb	Temp.	Dry Bulb
Air to tower	43.0		58.5
Water from tower to mine 1,680 gpm approx.		49.0	
Water from mine to tower 1,680 gpm approx.		67.0	
Cu.ft. of air per min. through tower		550,000 approx.	
Btu removed/min. tower from mine		251,900 approx.	
Horsepower consumed by tower		115 approx	
Tons of refrigeration to mine per hp. by tower		11 approx	

For the month of December, 1950, average temperature of the air at the tower was 41.9 deg. wet bulb, and average temperature of water from the tower to the mine was 48.7 deg.

A comparison of the June temperature averages with the December temperature averages shows that in June, by using precooled air, the water leaving the tower was 1.8 deg. below the wet-bulb temperature of the air, whereas, in December, the water leaving the tower was 6.8 deg. higher than the wet bulb temperature of the air.

The tower is operated as a standard tower during the winter months, from October until March inclusive, when the required cooling can be produced at reduced horsepower.

TABLE VIII. Heat Exchanger Design Data

Hot fluid	Water (low pressure)
Hot fluid	In shell
Hot fluid, total quantity lb./hr.	107,500 (215 gpm)
Hot fluid, in	89.2 deg.
Hot fluid, out	68.3 deg.
Cold fluid	Water (high pressure)
Cold fluid	In tubes
Cold fluid, total quantity lb./hr.	125,000 (250 gpm)
Cold fluid, in	66 deg.
Cold fluid, out	84 deg.
Heat load Btu per hr.	2,250,000
Total transfer area, sq. ft.	2,700
Pressure drop, fluid through shell	30 psi
Pressure drop, fluid through tubes	35 psi
Number of shell passes per unit	1 Crossflow
Number of tube passes per unit	1
Design pressure, shell	150 psi
Design pressure, tubes	2,500 psi
Number & length of tubes per section	64–216 in.
Total number of tubes for one battery	768
Size & gauge of tubes	¾ in. O.D.—13 ga.
Size of shell	10 in. I.D.
Material of tubes	Steel
Material of shell	Steel
Total weight of 6 batteries	144,000 lb. approx.

TABLE IX. Operating Data for a Typical Unit

Readings taken on 4,200 ft. level No. 2 plant—March 4, 1950

	Wet Bulb	Temp.	Dry Bulb
Water at cooling tower to mine		52	
High pressure water entering exchanger Approx. 300 gpm		54	
High pressure water leaving exchanger Approx. 300 gpm		65	
Low pressure water from coils to exchanger, Approx. 215 gpm		70	
Low pressure water from exchanger to coils, Approx. 215 gpm		54.5	
Air entering cooling coils—25,000 cfm	80		87
Air leaving cooling coils—25,000 cfm	63		63
Spray water circulated through air washer—125 gpm Btu per min. cooling on air		27,040	
Hp. consumed by this underground unit		65 approx.	

TABLE X. showing air-cooling performance of coils connected to Carrier units before and after Apr. 2, 1950, when the Carrier condenser-water cooling system was connected to the new cooling tower circuit. Note lower wet-bulb temperatures on Apr. 10.

Location	Date		Wet Bulb	Dry Bulb
3800 W. Coils	3/26/50	Air entering coils	77	86
3800 W. Coils	3/26/50	Air leaving coils	74	74
3800 W. Coils	4/10/51	Air entering coils	77	89
3800 W. Coils	4/10/51	Air leaving coils	69	69

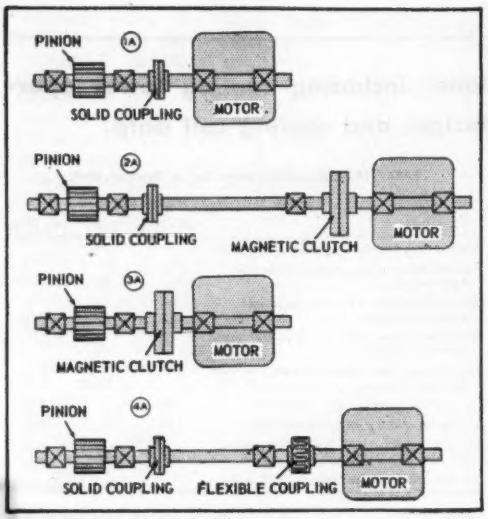
(The volume of air passing through the coils on both the above dates was approximately 55,000 cfm. The cooling capacity on this Carrier plant was 57.2 tons of refrigeration on the air March 26 and the same plant was cooling air at a rate of 143.6 tons of refrigeration on April 10, at a reduction in compressor motor load of approximately 30 hp.)

3600 E. Coils	3/27/50	Approx. 25,000 cfm—		
		Air entering coils	67	84
		Air leaving coils	63	63
3600 E. Coils	4/24/50	Approx. 25,000 cfm—		
		Air entering coils	72	84
		Air leaving coils	49	49

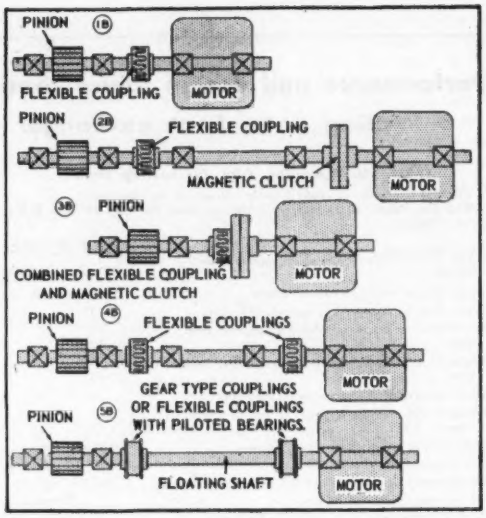
Note: A ton of refrigeration is heat removed at the rate of 200 Btu per min.

TABLE XI. General Operating Statistics

For 1950	Average wet-bulb temperature	52.9 deg.
For 1950	Average dry-bulb temperature	70.6 deg.
For 1950	Average relative humidity	28%
January 1950	Average wet-bulb temperature	42.1 deg.
January 1950	Average dry-bulb temperature	51.2 deg.
January 1950	Average relative humidity	45%
August 1950	Average wet-bulb temperature	63.5 deg.
August 1950	Average dry-bulb temperature	86.7 deg.
August 1950	Average relative humidity	25%
August 1950	Highest wet-bulb temperature	71 deg.
August 1950	Highest dry-bulb temperature	107 deg.
Approx. average Btu per min. removed from mine to tower		245,000
Estimated Btu per min. removed from mine by tower when six units of new cooling system are in operation, plus four Carrier refrigeration plants operating at full load on the 1800 gpm of return water		300,000
Approx. average gpm of water from storage tank to tower		50
Installed hp. on new cooling system		1,301
Installed hp. on Carrier system, excluding fans		2,020
Installed hp. on mine ventilation fans		1,825
Total installed hp. on mine ventilation and cooling		5,646
Present total operating load on mine ventilation and cooling		3,000 kw
Total air exhausted from mine		310,000 cfm
Estimated air reconditioned and re-used		90,000 cfm



THESE SO-CALLED STIFF DRIVES are not recommended.



"SOFT" DRIVES such as these are recommended with qualifications.

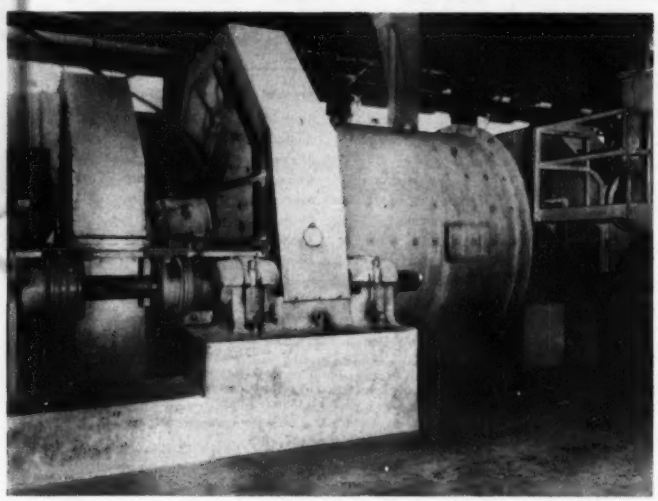
How To Choose the Drive for

High torques involved make this a matter of importance

E. J. KLOVERS

Basic Industries Machinery Dept.
Allis-Chalmers Manufacturing Co.

SELECTION OF PROPER DRIVES for grinding mills is important because of the high torques involved. On a 10½ x 10-ft. mill, for example, up to 108,000 lb. of balls must be lifted on starting and the load does not lessen appreciably during operation. Further, on wet grindings, the material often solidifies on the bottom of the mill during week-end shutdowns. In addition, continuous rotation of heavy loads puts a constant stress on the bearings and drive.

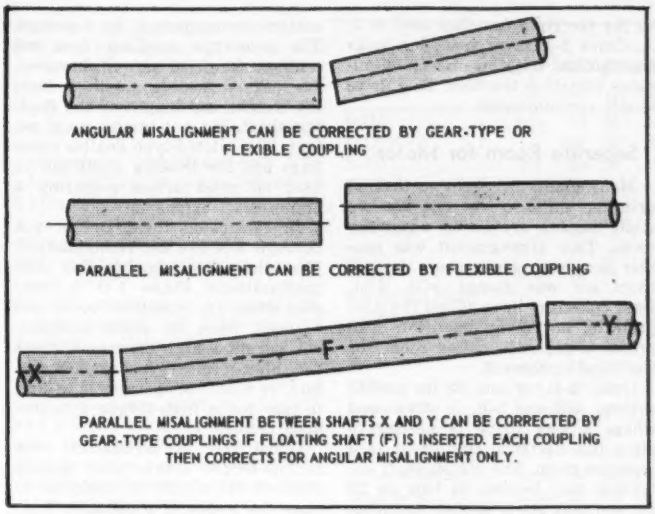


THE DRIVE of the 10½-ft. diameter ball mill, shown in this photograph, consisting of a floating shaft and gear-type couplings, is used where the motor is to be positioned away from the pinion, as in this instance.

Mill drives can be divided broadly into two types:

1. Indirect, in which a V-belt drive or other speed-reduction system is introduced between the motor and machine. For drives under 250 hp., speed reduction by V-belt drive has proved satisfactory. This type is inexpensive and minor speed changes can be made by varying the size of motor sheave. In addition, the V-belts serve to soften the drive and isolate the motor from vibration.

2. Direct, in which the driving pinion and motor rotate at the same speed. Direct drives are generally employed on grinding mills where power requirements exceed 250 hp. There are eight varieties of direct drives for grinding mills, each offering particular advantages and disadvantages.


ANGULAR MISALIGNMENT CAN BE CORRECTED BY GEAR-TYPE OR FLEXIBLE COUPLING
PARALLEL MISALIGNMENT CAN BE CORRECTED BY FLEXIBLE COUPLING
X
F
Y
PARALLEL MISALIGNMENT BETWEEN SHAFTS X AND Y CAN BE CORRECTED BY GEAR-TYPE COUPLINGS IF FLOATING SHAFT (F) IS INSERTED. EACH COUPLING THEN CORRECTS FOR ANGULAR MISALIGNMENT ONLY.

SHAFT MISALIGNMENT of three types, all exaggerated for illustration.

Your Grinding Mill

Stiff Drives and Soft Drives

Illustrations of various direct drives are shown. Drives 1-A through 4-A are known as stiff drives, 1-B through 4-B as soft drives. Drive 1-A is the simplest type of direct drive but can be troublesome. Motor and pinion shaft are joined by a rigid coupling. This is equivalent to a single shaft with four bearings. The two motor bearings must be in perfect alignment with the pinion-shaft bearings. If alignment is poor, the bearings will wear out repeatedly. The worse the alignment, the shorter their life.

The flexible coupling—Drive 1-B—permits some degree of misalignment. It permits use of roller bearings with their low coefficient of friction and low maintenance. While it is true that careful erection can place all drive components in alignment, the alignment can be lost during operation if the foundation settles or vibration flexes the supporting beam.

Synchronous Motor Characteristics

Synchronous Motor Type	Starting Torque	Pull in Torque	Pull out Torque	Starting Amp.	Approximate Comparative Costs
Normal torque	10%[1]	30%	175%	75%[1]	102%[6]
(with magnetic clutch)	40%[3]			150%[3]	
High torque					
(no magnetic clutch)	160%[3]	140%	225%	550%[3]	100%[7]
Two-step, part wound	85%[4]	140%	225%	280%[4]	104%[8]
	170%[5]			550%[5]	
Synchronous induction	150%		150%	250%[1]	117%[9]

[1] At 50% of full voltage.
[2] At full voltage.
[3] Current peaks at 150% when clutch is energized.
[4] At first step of part-wound motor.
[5] At second step of part-wound motor.
[6] Costs include motor, magnetic clutch, flexible coupling and reduced-voltage starter.
[7] Costs include motor, flexible coupling and full-voltage starter.
[8] Costs include motor, flexible coupling and two-step, part-winding full-voltage starter.
[9] Costs include motor, flexible coupling and reduced-voltage starter.

Drive 1-B may be mechanically ideal, having the advantage of being compact and easily maintained. But electrically, it may be far from satisfactory because of demands on the power utility.

Power Utility Must Be Considered

A direct-drive mill motor rotates between 180 and 450 rpm, while the horsepower demand will be between 250 and 1,000. Generally, it is in a class of 2 to 3 hp. per rpm. Sometimes an induction motor can be used, but in most cases its efficiency will be so low that many manufacturers refuse to build it. A synchronous motor seems to be the solution, especially since its capacitance can improve the overall plant power factor. But a synchronous motor must also have a large starting current demand so as to develop sufficient starting torque to start a mill. Many utilities will not tolerate this. Consequently, the transmission line and generator must be considered part of a mill drive.

If the utility will not permit the peak starting demand, a high-torque synchronous motor may be used. This type of motor starts as a wound-rotor induction motor with relatively low starting-current demand and reverts to synchronous operation when up to synchronous speed. It has advantages but its cost is usually prohibitive.

A normal-torque synchronous motor does not rate consideration because of its low torques: 40% starting, 30% pull-in and 175% pull-out torque. Its starting-current demand is low, but its starting torque cannot bring a mill up to speed. The use of a clutch, however, will permit the motor to start unloaded and then take up the load gradually.

Magnetic Clutch and Flexible Coupling

Although mechanical clutches work, they are large and costly, so magnetic clutches are used instead. The magnetic clutch, unlike the mechanical, permits the synchronous motor to run as a synchronous condenser when the mill is idle for maintenance or repairs.

The magnetic clutch is shown mounted in Drive 2-A and 2-B, modifications of 1-A and 1-B. Note that Drive 2-A shows a three-bearing pinion shaft. In fact, five shaft bearings and the clutch pilot bearing must be aligned accurately. A rigid coupling does not require that

the pinion shaft extension be supported. Any shaft extension used with magnetic clutches and spring-type flexible couplings must be supported by two adjacent bearings.

A magnetic clutch is not a flexible coupling. It does not allow for any misalignment and it does not soften the drive. Therefore 2-A is not recommended; 2-B is a good drive but it is rather long.

Drive 4-A substitutes the flexible coupling for the magnetic clutch, as shown in 2-A. This improves the drive. The flexible coupling softens what would be a stiff drive. The arrangement, however, requires perfect alignment of the two pinion-shaft bearings and the bearing on the pinion-shaft extension—not an easy alignment to make or keep.

Clutch and coupling manufacturers cooperated to produce a combined clutch and coupling as shown in Drive 3-B. The hub of the clutch has been replaced with a flexible coupling hub, thereby eliminating the shaft extension and its two bearings. While 3-B is a good drive, it does have erection and operational difficulties not found in 2-B.

In an effort to save space, Drive 3-A has been resorted to. Here the magnetic clutch has been substituted for the rigid coupling used in 1-A. Drive 3-A saves space but lacks the flexible coupling which eliminates vibration troubles. This drive is not recommended.

Separate Room for Motor

Many plants are built so that all grinding mills are in one section, while motors are in an adjoining room. This arrangement was popular in cement plants where the mill room air was fouled with dust. Dust collectors have solved the dust problem, but many operators still prefer a separate motor room for electrical equipment.

Drive 2-B, or one of its modifications, 4-B and 5-B, is often used where a long drive is needed to place the electrical equipment in a separate room. The pinion-shaft extension may become as long as 20 ft., and may act in torsion to soften the drive. This practice is not recommended because the shaft diameter usually has to be reduced dangerously close to minimum diameter before becoming an effective torsional member.

Drive 5-B uses gear-type alignment couplings or flexible couplings with piloted bearings. Neither type requires that the pinion shaft extension be supported by bearings. The gear-type coupling does not cushion the drive as well, however. The piloted flexible couplings limit the weight and length of the floating shaft, but not to any great extent. The piloted-type flexible couplings and the floating shaft can be used on most drives requiring a pinion-shaft extension.

In conclusion then, Drives 1-A through 4-A are not recommended. The others are recommended with qualifications. Drive 1-B is suitable when an induction motor can be used, when the power company will permit a high starting current for high-torque synchronous motors, or when the operator is willing to pay for a high-torque synchronous motor.

Drive 2-B is satisfactory for normal-torque synchronous motors where it is possible or desirable to place the motor at a distance from the pinion.

Drive 3-B is recommended for normal-torque synchronous motors where space limitations demand that motor be placed as near the pinion as possible.

Drives 4-B and 5-B apply to the same types of motors as used in 1-B, but when the motor is to be placed at a distance from the pinion.

Metals for the High-Speed Age

Developments such as jet planes and rockets have brought about stiffer requirements, leading to new applications.

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ON THREE WESTERN TRIPS which I have made in the past year it has been very noticeable that mining and concentration men are vitally interested in learning where their products and by-products are being used. They also want to know what effect the light metals are having on the old-line non-ferrous metals, and what materials are being used in jet turbines, electronics, and similar new applications. I have undertaken to prepare this paper to discuss some of these factors. My desire is to make the article informative rather than highly technical. To an increasing extent metallic and nonmetallic materials are supplementing one another in application to do a better or a cheaper job. An example is the increasing use of resins in paints to protect metals and in cladding metals. Another is the vitreous enameling of steel.

The Metals

The era of the automobile, streamlined train and airplane completely changed our metal economy. The incoming era of jet planes and rockets adds still another change in requirements. Although the automobile made its appearance at the turn of the century, it was about 1930 before the goal of all-metal construction was realized. The requirement of a cheap manufacturing cost and relative lightness without sacrificing strength spurred the development of alloy steels and of the continuous-strip mill. Corrosion resistance was improved by use of alloy metals and new methods of coating surfaces.

The work done to protect metal surfaces has varied from simple painting to cladding, electrodeposition, and more recently vapor-phase coating formation. For example, molybdenum can be made resistant to oxidation by treatment with a hydrogen-silicon tetrachloride atmosphere at 1000 to 1800 deg. C. to produce a molybdenum disilicate coating on its surface. Above 1600 deg. F., molybdenum has creep strengths superior to any

other ductile metallic material. Ingots can now be produced in sizes up to 400 to 600 lb. and metallurgists are learning to forge and extrude the metal into parts for high-temperature use.

Aluminum and Magnesium. The advent of the jet plane presented a completely new problem in materials of construction requiring strength and light weight. As a result, engineering attention was focused on the light metals, principally aluminum and magnesium.

Development of high-strength aluminum alloys, such as Alcoa's 25S and, later, the 75S types, permits the construction of planes of less bulkiness, greater strength and greater carrying power. Cladding the stronger but less corrosion-resistant aluminum alloys with pure aluminum was a milestone in construction.

Considerable interest is being shown in magnesium-zirconium alloys with zinc, or silver, or both, as the principal alloying element. The outlook is favorable for greater use in the United States of magnesium-zinc-zirconium alloys similar to Dow ZK60 containing about 6% zinc, 0.7% zirconium and the balance magnesium. More recently, magnesium-cerium alloys with moderately good load-carrying capacity at 600 deg.F. have been developed. The one recommended contains 2% of cerium, 1 to 1.5% of manganese and 0.2% of nickel.

High Temperatures Pose Stiff Requirements

Alloys for Jet Planes. The jet plane has requirements far more exacting than those of ordinary aircraft. The high temperatures developed have put new demands not only on engine parts but on exhaust pipes. The latter in some instances have been made of Inconel (75% nickel, 15% chromium and 10% iron) and refractory glass or enamel linings are being applied to the inside of exhaust parts. The gas turbine would not have been possible without the highly alloyed materials of construction resulting from metallurgical research in the last 10 years. At operating temperatures of 850 to 900 deg.F., a gas turbine will show zero efficiency. In this range the power output is completely absorbed by the compressor which supplies the air to the combustion chamber. High-temperature alloys have advanced far from the "stainless" steels of 30 years ago. Supercharger-disk materials must withstand a temperature of 1100 deg.F. under high stress. For this purpose, chromium-nickel-cobalt-iron alloys, strengthened with such other elements as molybdenum, wolfram[1], columbium or titanium, are used. One ferrous alloy used for disks contains 16% chromium, 25% nickel and 6% molybdenum. The gas-turbine blades used in superchargers and jet engines are subject to temperatures of 1500 to 1600 deg. F., and the metal, itself, sometimes reaches a temprature of 1500 deg. F. To secure stability, still more highly alloyed materials must be used and some are practically iron-free. The strongest materials suitable for precision casting are the cobalt-base alloys containing 40 to 70% of cobalt and such other additions as chromium and molybdenum or chromium, nickel, molybdenum, wolfram and columbium. A list of well-known and established high-temperature alloys is given in Table 1.

TABLE I. High-Temperature Jet Engine Alloys*

	C	Cr	Ni	Co	Mo	W	Cb	Ti	Fe	Other
S-816	0.4	20	20	44	4	4	4		3	
MIT NT-2	1	20	30	20	3	2.2			21	Ta-2
S-590	0.4	20	20	20	4	4	4		25	
61	0.4	28	1	67		5				
NR 88 [Co-Cr(9W)]	0.4	23	3	63		9				
Vitallium	0.25	28	2.5	62	5.5				1	
X-40	0.5	25	10	55		7			0.6	
422-19	0.4	26	15	51	6					
NR-90 [Co-Cr-Ni (5Mo.5W)]	0.4	23	18	46	5	5				
I-1360	0.10	10	70		5		2		4.5	Al-6 Be-0.5
N-155	0.3	20	20	20	3	2	1.0		0.32	N_2-0.11
6059	0.4	26	33	33	5					
Inconel X	0.05	15	73				1	2.5	7	
K-42-B	0.05	18	42	22				2.2	14	Al-0.2
EME	0.01	19	12			3.2	1.2		63	N_2-0.15
Refractalloy 26	0.05	18	37	20	3			2.8	18	Al-0.2
Nimonic 80	0.05	21	75					2.5	0.7	Al-0.6
19-9-DL	0.3	19	9		1.2	1.2	0.3	0.3	67	
Inconel	0.05	14	78						7	Cu-0.2
Hastalloy B	0.01		64		28				6	
Timken (16-25-6)	0.12	16	25		6					N_2-0.18
17W	0.5	13	19		1	2.5			60	

*Iron Age, Jan. 1, 1951

Ceramics in Jet Planes. Alloys still do not give the performance desired and research work is going on in many places on ceramic materials. A ceramic turbine blade is in the picture, although it probably will be segmented. Also, the so-called cermets will find application. These are ceramic materials, for example, pure oxides like alumina, sintered together with a metal in a manner similar to that employed in making cemented carbide tools, such as wolfram carbide. Bobrowsky[2] investigated ceramals of titanium carbide with 5 to 30% additions of cobalt, molybdenum or wolfram, for use as blade materials. Of the cobalt-bearing mixtures, those with 20 and 10% additions showed the highest tensile strengths at 1800 deg. and 2200 deg.F. (33,200 and 14,300 psi., respectively); these were as good as, or better than, the best alloy used for comparison.

A New Construction Material

Titanium. In any discussion, when mining men or metallurgists meet, the question of titanium arises. Where will its place be in the future metal program? Titanium should be viewed as a new material of construction and not as a substitute for stainless steel or aluminum. It has its own properties and will find its own uses. Its

[1] In this article, following the recommendation of the American Chemical Society, the term "wolfram" rather than "tungsten" is used.

[2] Bobrowsky, A. R., "The Applicability of Ceramics and Ceramals as Turbine-Blade Materials for the Newer Aircraft Power Plants," ASME Transactions, Vol. 71, pp. 621-29, August, 1949.

excellent resistance to chemical corrosion will find a place for it in the chemical industry. Its lightness plus outstanding strength-volume relations will make it useful in the airplane industry. Its specific gravity, 4.5, contrasted to 2.7 for aluminum, does not point to it as a natural to replace the latter. However, its melting point of 3137 deg.F., contrasted to 1200 deg. F. for aluminum, gives it an outstanding advantage where skin temperatures may be higher than those permissible for aluminum. An example is in rockets. A specific case may be guide vanes.

Titanium is easily alloyed and small increments of carbon, nitrogen and chromium make almost unbelievable improvements in strength. In many ways the physical metallurgy of addition of alloys to titanium parallels that of additions to iron.

Titanium at the moment has two distinct drawbacks—high cost of production and difficulty of fabrication. In sponge form it is sold for a price on the order of $5 per pound. Intensive research is bound to decrease production cost, as has been done in the past with aluminum, magnesium and other metals. Difficulty of fabrication is a more serious drawback. Rolling into sheet form is practical, but casting methods involve melting techniques which may never be cheap. As yet titanium is a hard metal to machine. This undoubtedly will be overcome by research.

Zirconium. Zirconium is another metal that is getting attention. It is not as interesting as titanium, because of its higher density, 6.5, and because of the poor domestic supply situation of its ores. Zirconium, as oxides and silicates, can be expected in the immediate future to find continued use in glaze and enamel opacifiers, in electric porcelain and in refractories rather than as metal. In connection with refractories, the oxide, stabilized with about 5% of calcium oxide, has given a unique high-temperature refractory with excellent resistance to thermal shock.

Change Rapid in Field of Electronics

The field of electronics is so large and diversified, and changes are being made so rapidly, that information of today may be obsolete a year from now. The following paragraphs cover what probably will be of most interest to readers of *E&MJ*.

Germanium. Germanium, which is obtained in part as a by-product from zinc-smelting operations, is today one of the most sought-for "minor" metals. Germanium, containing about 0.001 to 0.01% of an alloying agent such as tin, is replacing rectifier tubes, especially at high frequencies and for detector uses.

Selenium. Its use has increased greatly for use in rectifiers, particularly for equipment for electrodeposition of metals in plating. A growing new use is to replace the rectifier tube in small cheap radio sets. It also finds extensive use in the glass industry in decolorizing and making ruby glasses.

Calcium. In the form of a halophosphate this is being used in fluorescent-lighting tubes

Tantalum. In the past tantalum had uses depending on its chemical resistance. During the last year it has been put to use in capacitors. The purpose is to reduce size.

Metals for Tubes. Vacuum tubes come in a wide variety of types, kinds, and end uses.

Internal anodes (plates) are usually made of carbonized nickel, carbonized nickel-plated iron, tantalum, molybdenum or graphite. For power tubes and magnetrons having external anodes, OFHC copper and tellurium copper are used in relatively large quantities.

The heaters for power tubes (and some receiving tubes) are usually tungsten, either pure or with traces of other substances such as thoria and carbon. The heaters for most receiver tubes are alloys of about 95% of nickel with upwards of 3% of such alloying elements as aluminum, cobalt, silica, uranium and wolfram, either singly or in combination. The base metal of indirectly heated receiving-tube cathodes is a special nickel which is coated with oxides of calcium, barium and strontium. The glass-to-metal sealing alloys, Kovar, Fernico and Dumet, also constitute a significant amount of material.

A recent large use of metal is in the form of thin metal cones for television tubes. Two types of stainless steel are employed, AISI 430 and 446, both modified slightly in composition. In June of 1950, 500 tons of 446 were used for this purpose.

Cobalt. There has been a great demand for cobalt in television. It is being used in permanent magnets (Alnico) in speakers and in television tubes. However, within the last month or two RCA has brought out a new television tube not containing an electromagnet. This not only relieves the cobalt situation but should relieve the minds of readers who are worrying about what will happen when their present tube burns out.

Cobalt is also essential in certain high-temperature alloys, as for turbine parts, and in cemented carbides for drills and other tools and dies.

Supply Is the Keynote

The United States is a mineral-consuming nation. Even in normal times our demands have been increasing. With a second defense program within ten years the problem to supply the materials necessary for consumption is staggering. These increasing uses are putting a demand on metallic mineral supplies that is beginning to pinch.

In the metallic field we are being pressed as to reserves, although with foreign supplies and domestic beneficiation there seems to be no immediate imminent shortage of iron ore. The ferroalloy materials are not in such a favorable condition. Manganese appears to be the most critical. Molybdenum is in ample suply, as is nickel. Wolfram is less plentiful domestically than in World War II, but vanadium is in larger supply.

Aluminum and magnesium are, or soon will be, in ample supply. Today's production of titanium is meager, but ores exist in sufficient quantity to supply a substantial market which will spring up if prices are reduced.

In the non-metallic field we are much more favorably situated than in the general metallic field. With an improved technology, ceramic materials will take a more important part, even than now, in our engineering economy.

There are going to be shortages, particularly for civilian consumption, of most metallic products in our planned defense economy. Vitreous enameled articles are likely to be in short supply because of steel shortage. There should be but few shortages in the nonmetallic field provided labor is available.

Table 1. Here are the Principal Active Mines in the Philippines, 1950-51.

GOLD	MANGANESE	CHROMITE
Atok-Big Wedge	British-American Corp.	Consolidated Mines, Inc.
Balatoc	Cia. Minera de Filipinas	Acoje Mining Co.
Benguet Consolidated	Luzon Stevedoring Co.	Misamis Chromite
Mindanao Mother Lode	Palawan Manganese Mines	Luzon Stevedoring Co.
Lepanto Consolidated	Palawan Mining Corp.	
Surigao Consolidated	Amalgamated Minerals	IN REHABILITATION
Taysan Gold Mines	De los Santos Manganese	Baguio Gold Mining Co.
Surigao Placer Mining Syndicate	Philippine Base Metals	Itogon
Tambis Gold Dredging	General Base Metals	San Mauricio
Nor-Mind Ventures (Placer)	Seleo Manganese	United Paracale
	Badillo Mining Co.	Coco Grove
IRON		
Philippine Iron Mines	LEAD-SILVER	UNDER DEVELOPMENT
Samar Mining Co.	Looc Lead-Silver Mines	Masara Consolidated Mines
Marinduque Iron Mines		

How Philippine Mines Are Meeting the Future

Last month John Huttl gave a first-hand account of the economic and political problems hampering Philippine mining. Here is his report on the production problems at individual mines and their solutions.

JOHN B. HUTTL, Associate Editor

BACK IN LATE 1941, Philippine mining men were congratulating themselves on having pushed mineral production up to what looked like first place as a contributor of wealth to the Islands' economy.

As of Dec. 6, 1941, Philippine mining was in position to finish the year with an output valued at P100,000,000,[1] which would have eclipsed sugar, the No. 1 product, in value for the first time. This would have climaxed 10 years of rapid growth from 1931's value of P7,524,867 to a value of mineral production in 1940 of P94,897,581.

Now, of course, a good part of the job has to be done over again. At the time of liberation, and for a period thereafter, the Philippine mining industry was nothing but a litter of wreckage. Difficulties with supply, personnel, and transport have been almost insuperable; yet a remarkable recovery has been made. The mining industry is again contributing to the welfare of the Republic, with an output in 1950 valued at P56,903,698.

[1] The official exchange rate in the Philippines is P2 to $1 (U.S.). Because of the excise tax of 17% now in effect the legal exchange rate is P2.34 to $1. However, open market exchange rate in Manila on August 1 was reported at P2.80 to $1. This is a considerable improvement over the rate prevailing earlier this year, i.e., P4 to $1.

A little-known but significant fact regarding the growth of Philippine mining up to 1941 is that American capital had little or no share in it. Biggest factor in the expansion of mining was a pool of speculative money created by the sugar industry. The same source is carrying the burden of re-establishing the mining industry, but there is certainly a greater opportunity than formerly for entrance of foreign capital, if an encouraging atmosphere can be created for it by any means.

A list of mining properties now operating is given with this article. The following paragraphs outline what I found at the various mining properties I was able to visit.

Philippine Bureau of Mines. Demetrio Andres, director of the Philippine Bureau of Mines, and his staff set up shop in the gutted Bureau building soon after the liberation. All records, books, and equipment were destroyed, but the staff has managed to restore much of the damaged property and carry on normal activities.

Mr. Andres has submitted to the Secretary of Agriculture a five-year program for his Bureau. Major objectives are: 1. development of petroleum resources; 2. geological and mineralogical surveys; 3. survey of fertilizer minerals; 4. increased activation of regula-

tory functions of the Bureau of Mines. Cost of the program is estimated at P16,350,000.

Marsman & Co., Inc. Marsman operates four gold mining properties: Itogon, United Paracale, San Mauricio, and Coco Grove, the last-named a placer property. Of these Itogon and Coco Grove suffered practically complete destruction of their surface facilities. Losses were less heavy at the other two mines, but the P5,779,361.98 received thus far by the company in war damage claims is wholly insufficient to rehabilitate the mines and provide operating supplies. The company has a loan application with the Rehabilitation Finance Corp. for P3,600,000.

At Coco Grove, one dredge was sunk by the Japanese and the other, the "Mary Angus," stripped of its machinery. However, gold production was expected to begin again in July. Power lines were run in from United Paraacle's power plant, and repair work on the "Mary Angus," a 10-ft. Bucyrus-Erie dredge, was about completed.

Itogon is being equipped with a 10,000-ton per month mill which is expected to be running this fall.

San Mauricio has a 9,000-ton per month mill under construction, and United Paracale is building one rated at 8,000 tons monthly. Both are expected to be producing by the end of 1951, assuming that loans, equipment, and supplies become available as planned.

NEW MILL of Mindanao Mother Lode handles 300 tons daily of gold-copper-lead ore by flotation-cyanidation. Quonset building houses new diesel plant.

STEAMER TRIP took John Huttl to Surigao with Captain Jensena, at left.

Mindanao Mother Lode Mines, Inc. It is a 2½-hr. flight via Philippine Air Lines from Manila to Cebu, the Republic's second-largest city. Here one sees a reminder of the war in the sunken ships dotting the harbor, but in the city itself most of the scars of the fighting of 1945 have been erased.

Transportation was not available to Leyte at that time, but I could reach Surigao aboard the M. V. *Fernando Escano,* Marciano Jensena, master. Although the ship was crowded, the cheerfulness of the passengers made light of any discomforts. I was much impressed by the good behavior of the many children who were aboard.

In Surigao, I was met by A. H. Crenshaw, superintendent of Mindanao Mother Lode Mines, who was directing operations in the absence on vacation of L. E. Smith, resident manager. I was entertained royally by the Crenshaws; their hospitality will always be remembered.

At the mine office, I met J. C. Curtis, assistant superintendent; Santos Murillo, night supervisor; I. N. Nidea, metallurgist; A. Navase, assistant metallurgist; Ernst Schneider, master mechanic; S. A. Año, accountant; and Dr. Jose Geotina, who is resident physician.

The orebodies at Mindanao Mother Lode are in an andesite porphyry intruded into older limestones and shales. The ore carries pyrite, chalcopyrite, and minor amounts of galena and sphalerite. Gold, very finely divided, is associated with the pyrite and the chalcopyrite.

The mine is opened by the main adit, which forms the 200 level of the mine. There are six more levels below the adit, reached by the interior Hargis shaft. Principal vein systems are the Tabon-Tabon, First and Fifty, and the Godbe. Vertical panel stoping is used where the vein walls are strong enough, because it keeps mucking costs low. In wider or weak-walled veins, timbered cut-and-fill stoping is used.

The mine has to pump about 40½ tons of water for every ton of ore hoisted. During 1950, about 1,077,500,000 gal. of water containing 1.20 lb. per ton of sulphuric acid was pumped against an average total dynamic head of 614 ft. A good part of the power load of the property goes for pumping. The diesel power plant has a capacity of 3,100 kw., and demand ranges from 1,000 kw. to peaks of 1,900 kw.

The entire surface plant, including the mill, was destroyed in the war. The company has received P1,892,820.31 from the War Damage Commission on a claim amounting to P3,604,467.11. The new mill is handling over 300 tons daily of ore averaging 0.56 oz. gold per ton.

The complex nature of the ore has given rise to several flowsheet changes since the mill started. Currently, the flowsheet includes: trommel washing, hand sorting, two-stage crushing, grinding, semi-selective flotation, cyanidation of pyrite and copper-lead con-

centrates, and bullion production. Pyrite concentrate is reground before cyanidation. Copper-lead concentrate is re-treated in a separate cleaner circuit, the concentrate going to cyanidation and the tailing going to a smelter.

Gold recovery amounts to about 89.6%, 60% of it as bullion. Ratio of concentration is 40 to 1. Milling costs per ton, including marketing, smelting, and refining costs, are P8.69. Total operating cost is P29.45 per ton of which P15.37 is the mining cost, and P5.39 is the general overhead.

Dr. Manuel Lim is chairman of the board, and T. M. Jordan is president of Mindanao Mother Lode Mines, Inc.

DRAGLINE DREDGES would be more widespread in the Islands if equipment and skilled operators were available. This is a 54-B Bucyrus-Erie, 2-yd. Essco bucket, feeding Bodinson washing plant for Surigao Placer syndicate

Surigao Placer Mining Syndicate. A short distance from the Mindanao Mother Lode property is the mine of Surigao Placer Mining Syndicate. The company is using a 54-B Bucyrus-Erie dragline feeding a 150-cu. yd. per hour Bodinson floating washing plant. Overburden is stripped by a wheel scraper.

Overburden runs from 3 to 4 ft. in thickness and minable gravel runs from 35 to 38 ft. in thickness. Gold is about 60 centavos per yd. Ground ahead is prospected by Hillman drills and 4x4-ft. pits. Operations are directed by L. F. Lang.

Nor-Mind Ventures. Not far from the Surigao Placer property is the mine of Nor-Mind Ventures. It is a dragline-dredge operation, but at the time of my visit the equipment was still being moved in.

COMPLEX ORE makes for complex flowsheet in this 325-ton mill of Surigao Consolidated. Bulk flotation recovers gold, iron, copper, lead, and zinc; separation is by flotation and cyanidation, plus electrolytic purification of gold.

Surigao Consolidated Mining Co. The second lode property in the Surigao district is that of the Surigao Consolidated Mining Co. near Magpayan. O. F. Weber is president and general manager; H. E. Heide is assistant manager; and J. B. Harrison, general superintendent.

The country rock at Surigao Consolidated is largely old sediments, limestones predominating. The orebody is an epithermal deposit of brecciated limestone and arkose. Values are in gold, copper, lead, and zinc.

The mine is opened by three shafts, the newest of which, the North shaft, is four-compartment and is being sunk to 700 ft. The North shaft is to be the main production shaft. Hoisted ore will go to the mill via an aerial train to be installed.

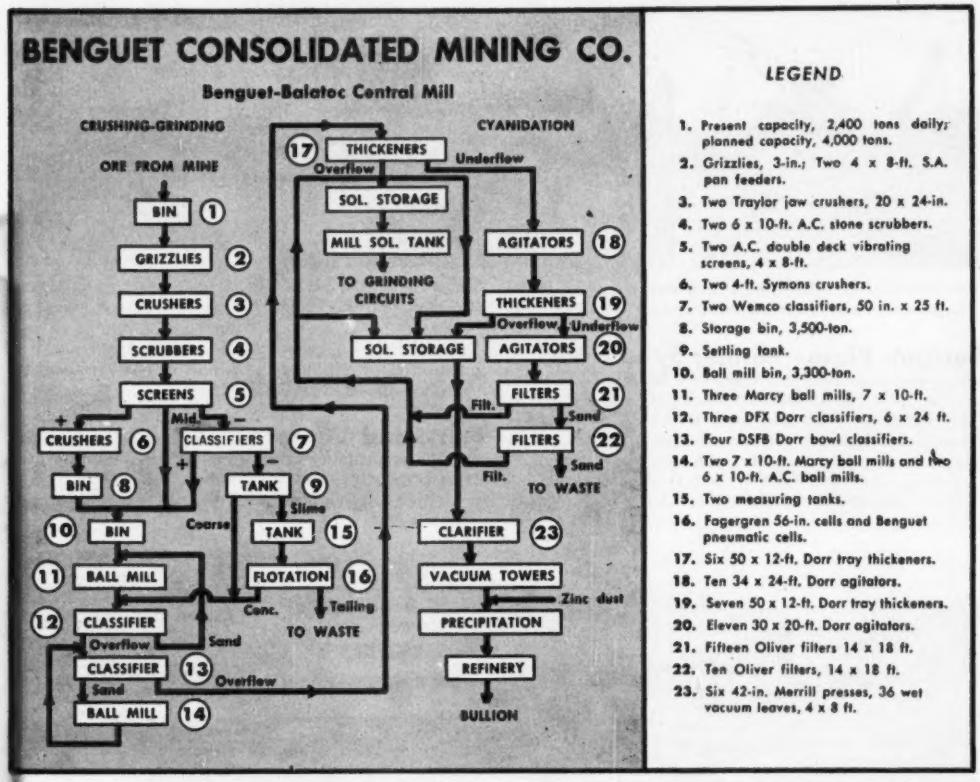
Surigao Consolidated is probably the only mine in the

world using saw mill slabs for stope filling. Square set mining is used. Daily output is about 325 tons.

The complexity of the ore requires frequent changes in flowsheet.

The flotation plant produces a lead-gold concentrate carrying 40% lead and 3 oz. gold per ton, and a zinc concentrate. The flowsheet involves regrinding and recirculation, reagents are used to make the lead-zinc separation. The tailing from the regrind flotation circuit is cyanided. Because of the low fineness of this gold obtained from the cyanide plant, it is refined electrolytically.

Masara Consolidated Mines Corp. In the southern part of Mindanao, Masara Consolidated Mines Corp., Clinton Bernard president, is prospecting several gold, copper, silver, lead, and zinc occurrences in the Davao area. These are owned by the Elizalde interests, with whom the Masara company has an operating contract. T. L. White, manager, is directing operations.



Benguet Consolidated Mining Co. Baguio, in Mountain Province, is 167 mi. north of Manila. 1½ hr. by P.A.L.'s DC-3. It lies in a region of pine parks, rolling hills, and invigorating mountain air.

The mines of the region are within a short distance of Baguio, connected to it by good highways. Though the city and the mines suffered considerable damage in 1945, reconstruction here has been so rapid that only a few bombed buildings still await repair.

The district is still the leading gold producer in the Islands, although the number of active mines has fallen from 14 in 1940 to three in 1951, with two being rehabilitated. The three now in operation are Benguet Consolidated, Atok-Big Wedge, and Lepanto Consolidated. Baguio Gold Mining Co. and Itogon Mining Co. have new mills under construction.

In the company of J. S. Peterson, vice president and general manager, I visited the rebuilt surface plant at the Benguet and Balatoc properties and the new central Benguet mill, which is now handling 2,400 tons daily, R. W. Crosby is the general superintendent and Cecil L. Elliott is mill superintendent.

With plans on foot to raise capacity to 4,000 tons daily, the company has done extremely well in its rehabilitation job. Factors in its success were: getting started as soon as possible after the end of the war, taking full advantage of pre-war equipment and supplies that could be rounded up and used. Nearly 75% of all Benguet's present equipment has been reclaimed and repaired. It had been scattered by the Japanese all over the Islands. So far the company has spent $17,711,278.40 on rehabilitating the Benguet and the Balatoc mines, and has been paid a total of $10,154,723.10 in war damage claims.

At the Benguet mine, the gold occurs finely divided and associated with pyrite, marcasite, sphalerite, some tetrahedrite and galena, in a gangue of fine grained quartz. This quartz, which makes up the bulk of the vein filling in the mine, occurs as several varieties. The gray, cherty variety carries most of the gold.

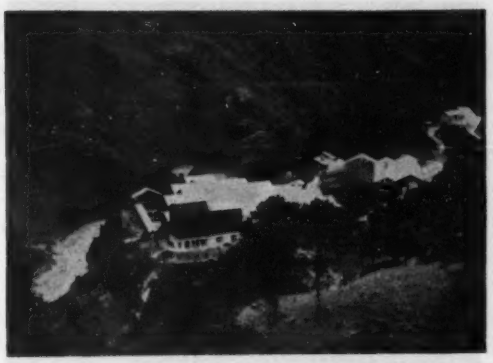
At the Balatoc mine, the veins occur as irregular

shoots in a quartz-calcite system. Country rock is a diorite with andesite intrusions. Gold is associated with pyrite, but some free gold is found.

Benguet ore runs $9.70 in gold per ton, and Balatoc ore runs $8.56. Ore supply ratio for the two mines is 40:60. Ore is hauled to the central mill in trains of 3-ton cars drawn by trolley locomotives. Power for the properties is furnished by 15 Worthington diesel engines, 13 of 650 hp. and two of 750 hp. A hydro-electric plant supplies additional power.

In the central mill, the flowsheet involves: two-stage crushing, two-stage grinding to 75% minus 200 mesh, cyanidation. Primary slimes are treated in Benguet pneumatic and Fagergren flotation machines. Details appear in the accompanying flowsheet.

In Baguio, I also visited with Roscoe Cannon, manager of Atok-Big Wedge, but I was unable to reach Frank Delahunty, who has charge of rehabilitation at Baguio Gold. To Mr. Cannon and to Mr. and Mrs. Peterson, my thanks for their hospitality.



BENGUET'S new central mill plans increase to 4,000 tons daily.

CHROMITE, metallurgical grade, is product of Acoje Mining Co. on Zambales. Huks burned old buildings March 28; this is new 1,000-ton concentrator.

OFFICIALS of Acoje: Jesus Cabarrus, president; J. D. Cuyugan, manager.

Acoje Mining Co. I had the good fortune to travel to the property of Acoje Mining Co. in the company of Jesus S. Cabarrus and J. D. Cuyugan, president and general manager, respectively, We made the trip in a Norseman plane of Pacific Airways Co. piloted by Albert Onstott, the president.

It was an hour's flight to Santa Cruz, a small settlement on the coast of Zambales, whence a station wagon took us up to the company's big chromite property 30 km. away.

L. W. Shaner, resident manager, took us on a tour of the Acoje mine workings and buildings. Much of the surface plant, destroyed by the Huks on March 28, had already been rebuilt. The mine is one of the largest producers of metallurgical grade chromite in the Philippines, and plans are to increase its capacity.

A 1000-ton concentrator is under construction, new diesel units will be brought in for additional power, a landing field is to be built, and a showing of nickel and platinum ores will be investigated.

The chromite is mined by top-slicing and square setting, depending on the size of the orebody. Sub-level caving will be tried where it seems suitable. Ore shipped carries about 48% Cr_2O_3.

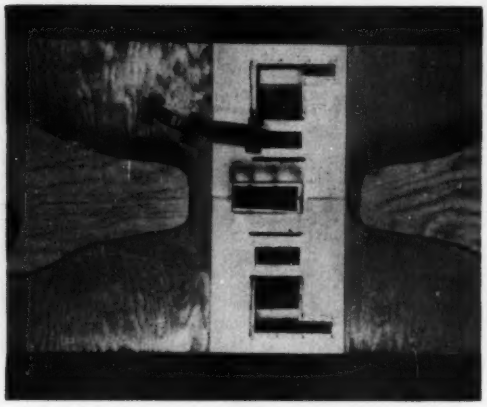
Lower grade ore will be treated in the new concentrator by crushing, rod mill grinding, sizing, tabling, and spiral treatment. Space is provided for a sink-float plant if need for one is indicated.

Prospects Good

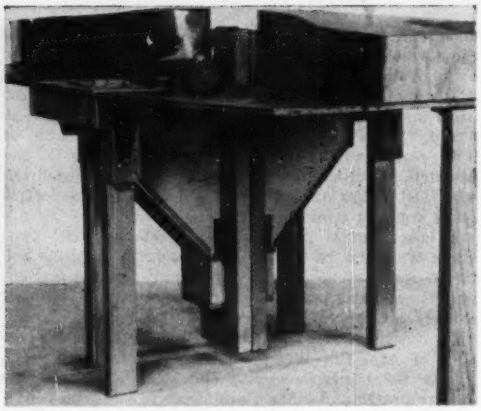
The long-term prospects for Philippine mining, as I saw it on this trip, are good. The mineral wealth of the Islands is very real and is extensive. There is no physical reason why the Philippine mining industry should not climb on beyond the mark it was about to set in 1941.

But there must be created a climate attractive to greater investment of capital, both domestic and foreign. There must be set up the kind of working atmosphere that will attract, not repel, the outside technical assistance that the mining industry needs now, and will need for years to come.

Further, there must be created a stable, reasonable political and economic climate in which the mining industry can grow, and to which it can make its rightful contribution. Philippine mining has ahead of it a great future, as great as that of the new Republic itself. But there is much work yet to be done.



SCALE MODEL shows pillars, grizzlies of shaft station, and truck and trailer used for hauling ore.



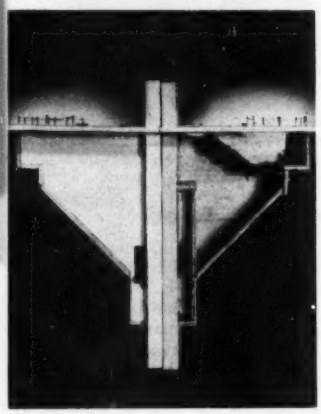
MODEL IS HINGED so that sections through grizzly, skip pockets and shaft can be examined by mine staff.

It Pays To Use Scale Models . . .

Scale models for construction projects reveal design problems, save costly errors, and help operating staff understand objectives.

. . . For Skip Pocket Installation

F. N. BULL, JR.
Eagle Picher Mining and Smelting Co., Miami, Oklahoma



SECTION THROUGH MODEL reveals grizzly, pocket and skip loading details.

MANY COMPANIES face the problem of presenting an idea or proposal so that it will be understood readily by all people concerned. For example, the Eagle-Picher company planned to install a complicated skip pocket and realized that the plans for the pocket would have to pass through many hands, from top executive to carpenter foreman. It was therefore decided to prepare a scale model to simplify the usual problem of poring over elaborate sets of drawings.

Although built to scale, the model was not a highly finished job. (See above illustrations.) However, it did contain enough essential detail to present all important aspects of the installation.

A second purpose of the model was to solve design problems. As it was planned to haul ore from various faces to the skip pocket by truck and semi-trailer, it was necessary to locate the grizzly so that the trucks could drive directly over the pocket wall without being forced to back in or maneuver for position before dumping. The grizzly also had to be spotted so that the rock would flow directly into the skips.

Hence a model truck and semi-trailer were built with dual wheels, steering arrangement and a fifth wheel. It was then possible to determine how the loaded truck could move along the side of the pillar across the grizzly, dump, and then return to the working face. (See plan view of model.)

This model was made of two small pieces of wood and a bit of aluminum for the fifth wheel. Wheels were cut with a jig saw, and small nails were used for the axles. A bent safety pin made the steering gear.

The model of the pocket and pillars was built of plywood, small pieces of pressed wood, blind stock and a few hinges. It was built in sections and hung on the supporting frame. Each section could be removed for inspection. The sides containing the pillars were hinged so that it could be easily carried. In fact, the model made a trip by air with one of the company executives as personal baggage. Cost of materials was less than $10.

Spurred by the success of the skip-pocket model, the company used another scale model to solve or demonstrate mining methods. A scale model of an orebody was built of plywood with a light supporting wooden framework. Draw holes were cut in the bottom and fitted with gates. Selected crushed rock was then used to represent broken ore in the stope. This model permitted operators to see how much leveling would be necessary to allow a tractor mounted with drills to work on top of the broken ore. By opening the gates and allowing the rock to run out, the model clearly showed how the top of the pile could be bulldozed out so that the tractor could move up and down the vein to drill holes in the roof.

With the model before them, all men concerned could see the problem and how to solve it. The model provided an excellent opportunity for ground bosses and experienced operators to express their opinions and advice even though they were unfamiliar with this particular mine where studies were made.

To get the greatest benefit, scale models should not be left in the main office, but should be sent directly to the job so that men working on the construction project can have a clear idea of what is expected of them.

Without question, the time saved by men using the model far exceeds the time required to construct the model, and engineers have undoubtedly been spared costly mistakes by referring to models to work out difficult design details involved in the mining projects.

. . . For Sink-Float Plant Installation

H. R. BANKS

Superintendent, Sullivan Concentrator of Consolidated Mining and Smelting Co., Chapman Camp, B. C.

THE USE OF SCALE MODELS in major construction offers advantages of sufficient magnitude to warrant the trouble and expense entailed.

The ability to think three dimensionally is a natural development for the design engineer. The operations engineer, however, is accustomed to viewing his equipment in the field. Therefore, the scale model becomes the meeting ground of operational experience and design.

The ability to place equipment with the least amount of effort or expense is a distinct advantage in setting up a new structure or introducing a major addition in an existing plant. The construction of the sink and float plant at the Sullivan concentrator embodied the introduction of several flow changes and illustrated the advantages in the use of a model.

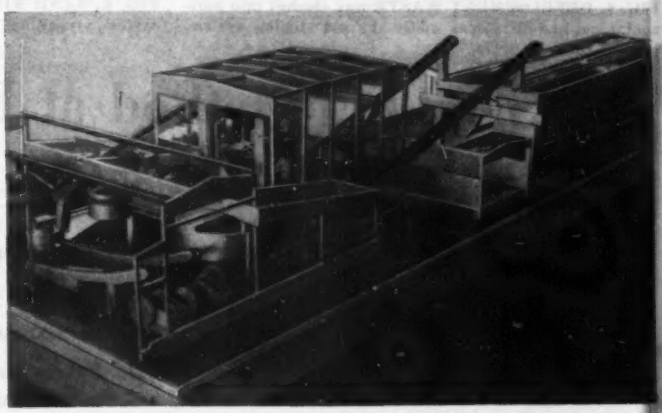
Originally mine ore passed through the coarse crushing plant on the surface adjacent to the main adit, followed by fine crushing at the concentrator. The coarse crushing plant was moved underground, and the ore crushed to the sink-float feed by means of jaw crusher and Symons crusher. Electric haulage from the ore bin underground to a receiving bin at the concentrator was installed.

At the concentrator, the sink-float plant was erected between the original fine crushing plant and the two storage bins formerly used to store the product from the fine crushing plant. One of the storage bins was allocated for handling the float product, and the other for handling the sink product, which now became the main feed to the balance of the concentrator circuit.

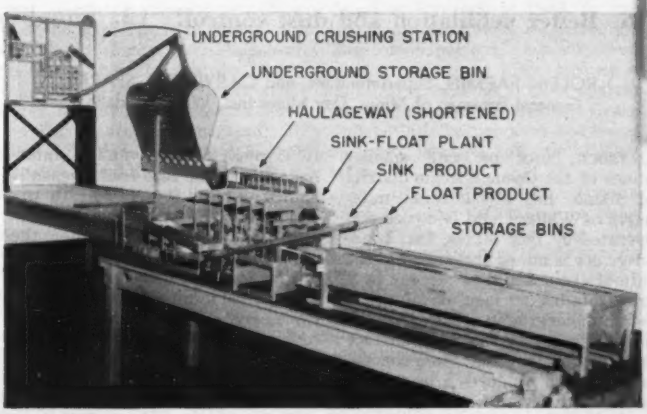
As the float product was to be used for backfill in the mine, a conveyor was constructed to take the float, along with the iron sulphides used for cementing the backfill, to a small storage bin from which it could be delivered to the haulageway for return to the mine.

There were several changes or additions to the existing plant, and the whole project involved a substantial expenditure. It was therefore decided to build a model of the new system. Scale for the model was ¼ in. to the foot. Plywood was used for the equipment where relatively wide dimensions were involved, while the remainder of the structure was made from wood strips.

This comprehensive model of the entire plant provided an excellent vehicle for the discussions of all phases of the new equipment, and minimized the cost of drafting, or of ultimately making changes in the plant after construction.



SINK AND FLOAT PRODUCTS of new plant are delivered to separate storage bins at right. Detail of sink-float plant is shown in foreground.



COMPREHENSIVE MODEL OF SINK-FLOAT PLANT and underground crushing plant enables staff to perfect operating details in the design stage.

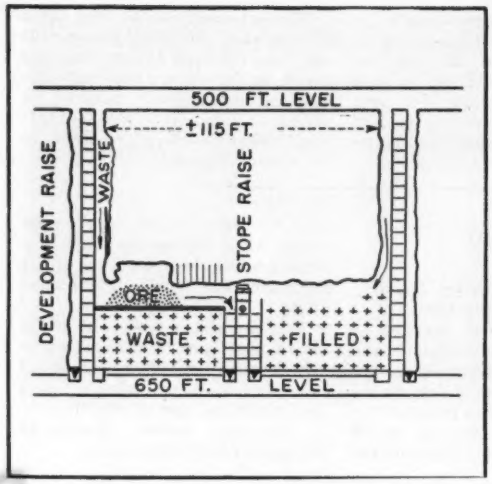


FIG. 1. DEVELOPMENT WASTE was slushed into horizontal cut-and-fill stopes under the old stoping system.

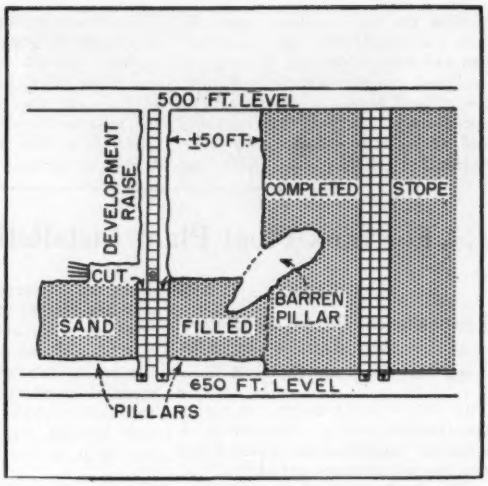


FIG. 2. SAND FILL is pumped into stopes under new system, resulting in many advantages listed below.

Sand-Fill Method at Dayrock Resulted in These 12 Benefits:

1. Lower mining costs per ton as compared with waste-fill methods.
2. Greater flexibility for stoping irregular or perched ore blocks.
3. Less dilution of ore.
4. Better support of stope walls.
5. Lower costs for chutes and manways.
6. Better ventilation and dust control.
7. Better preservation of timber.
8. No loss of fine ore to fill.
9. Improved safety for men.
10. Fewer man-hours of indirect labor for timbering and filling.
11. Reduced volume of mill tailing to be disposed of on surface.
12. Simplified stoping cycle.

ROLLIN FARMIN, Superintendent, and CARVILLE E. SPARKS
General Foreman of Mines, Day Mines Inc., Wallace, Idaho

DAYROCK, ONE OF THE smaller mines of the Coeur d'Alene district of Idaho, lies about three miles north of Wallace, and is owned and operated by Day Mines, Inc. Lead-silver ore is mined and milled at the rate of about 220 tons per day by a crew totaling 90 men, 65 of whom work underground. The Dayrock mill, adjacent to the mine surface buildings, is an all-flotation concentrator which produces a lead-silver concentrate for rail shipments to a smelter. Broken ore is hoisted in the mine from a maximum depth of 800 ft. through a small, vertical, internal shaft to the zero level, thence is hauled out an 800-ft. adit to the crushing plant at the head of the mill. Men and supplies enter the mine 100 ft. lower, at the elevation of the bottom of the mill.

Principal mining activity is along two nearly parallel veins, the Dayrock and the Ohio. They lie about 250 ft. apart, are generally steep-dipping, but are characterized by numerous spurs, reversals and areas of flattened dips. Most of the ore in the stopes is less than 3 ft. wide and is not clearly separated from the adjoining wall rock. Oreshoots are highly discontinuous, both from erratic mineral deposition and from a multitude of small fault displacements. The country rock is the St. Regis quartzite (Algonkian age) that here is much shattered and sheared, probably by the great Dobson Pass fault against which the veins terminate in the eastern part of the deposit.

Most of the Dayrock mine openings are in shattered St. Regis quartzite and require timber or other support for the ground, which otherwise sloughs until the opening becomes filled. This ground condition, plus the physical nature of the

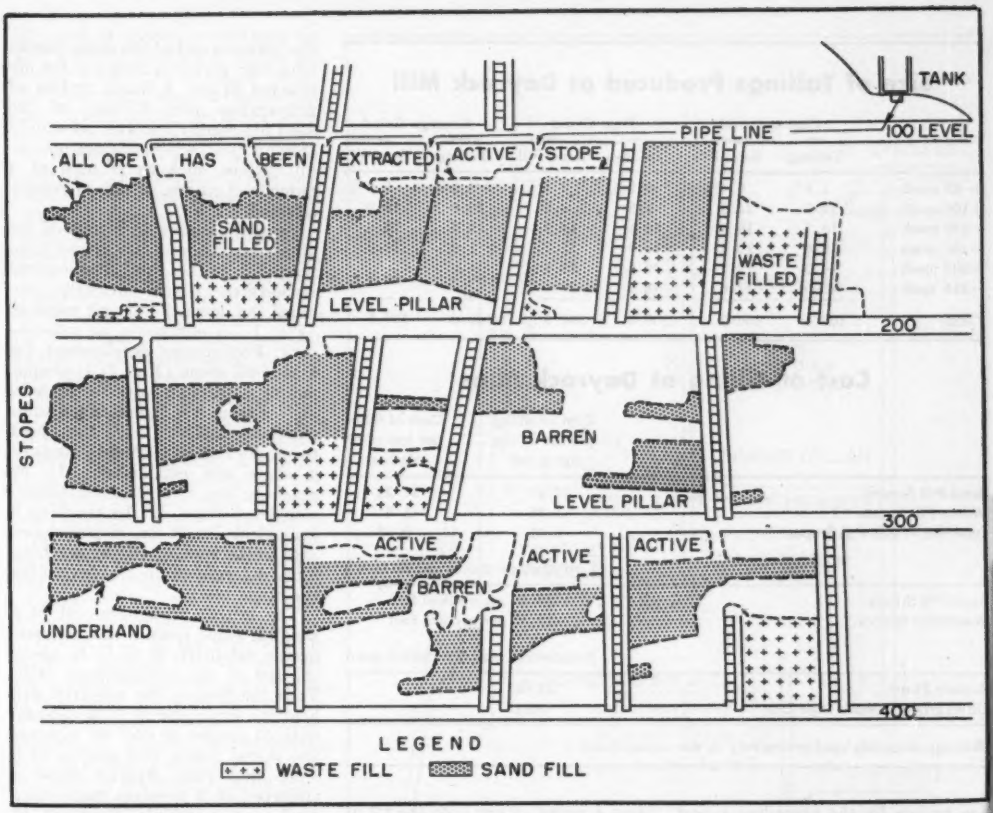


FIG. 3. NOTE IN THIS LONGITUDINAL SECTION of the mine how sand filling has permitted extraction of irregular orebodies and mining around pillars of waste. Fewer raises are required to mine with sand-fill methods than with waste-fill methods because the sand fill can be run into the stopes through pipe lines.

ore, calls for stoping technique which will permit: (1) breaking the narrow ore with as little dilution as possible, (2) support of the stope walls, leaving a minimum of the excavation unfilled, and (3) flexibility for following erratic ore, along which barren areas and fault "windows" commonly lie across the path of an advancing stope.

Waste Fill Used Previously

The first stoping at Dayrock was by open, timbered, overhand excavation, but by about 1930 the general use of waste fill had been adopted. The stopes were timbered with regular sets; as soon as a new tier of sets was completed the underlying tier was filled. About 1937 stoping by the conventional horizontal cut-and-fill method was adopted and remained in use until the sand-fill method was introduced in 1949.

In the horizontal cut-and-fill stopes (Fig. 1) development waste is dropped into the stope through a chute from the level above and is spread by a scraper and a slusher hoist along the stope to provide a work floor about 7 ft. below the stope back. A flooring is laid over the waste, then the next cut in ore is drilled up-dip with stoper drills and is blasted down onto the flooring. The broken ore is scraped into a down-chute, any necessary timber is installed and the flooring is lifted. The entire cycle then is repeated.

In 1948 the above-described method was refined to include an additional fill of waste, after drilling had been completed to lift the work floor within about 3 ft. of the collars of the drill holes which then were loaded by use of jointed tamping sticks. Thus, a minimum of unfilled excavation was left open beneath the blastholes and less wall rock sloughed down on the broken ore after the blast.

Sand Fill Started in 1949

The present horizontal cut-and-sand-fill stoping method was introduced at Dayrock in 1949. In the two years prior to its adoption, the Day management experimented with a pilot plant after making a study of a sand-fill stoping system at Idaho-Maryland Mines, Grass Valley, Calif., which then was being operated by the authors of this article.

In Dayrock sand-fill stoping (Fig. 2), the excavation is by a succession of horizontal cuts, each about 6 ft. high. Most of the rounds are drilled horizontally into the breast of a bench that is advanced from the central raise to the end line of the stope. Ore broken by each round is scraped back into a chute at the through-raise, before the next round is drilled. The general stoping cycle is as follows: In the first part of the daily work, the

Size of Tailings Produced at Dayrock Mill

	Coarse Grind		Fine Grind		Average Grind	
	Tailings	Sand-Fill	Tailings	Sand-Fill	Tailings	Sand-Fill
+ 65 mesh	3.8%	6.4%	0.2%	0.5%	3.0%	5.0%
+100 mesh	10.0	23.3	2.5	3.8	10.0	18.0
+150 mesh	14.7	19.0	14.1	18.9	12.0	20.0
+200 mesh	18.8	19.3	15.2	21.7	11.0	17.0
+325 mesh	24.2	19.2	19.5	23.1	64.0	40.0
−325 mesh	28.5	12.8	48.5	32.0		
Total	100.0	100.0	100.0	100.0	100.0	100.0

Cost of Filling at Dayrock Mine

	Cost of filling per ton of ore extracted	Cost of filling per ton of fill emplaced
Sand-Fill Stopes	$0.67	$1.23
Waste-Fill Stopes	1.21	1.81
Quarried-Waste-Fill Stopes	6.01	9.02

	Cost of stope chutes and fill lacing
Sand-Fill Stopes	$8.80 per vertical foot
Waste-Fill Stopes	12.57 per vertical foot

	Installation cost of sand-fill plant
Surface Plant	$3,485
Underground Trunk Pipe Line	3,345

(Salvage materials used extensively in the surface plant.)

ore broken by the preceding round is scraped back into a down-chute. Another round of holes then is drilled forward into the breast, usually with a stoper drill, and is blasted at the end of the shift. When the daily slushing and breaking operations have advanced the excavation to the end line of the stope, completing a horizontal cut, the opening is prepared for fill by lacing off the chute and any reserved travelways. Then the remaining open volume of the stope cut is filled with dewatered mill tailings ("sand"), leaving only about 1 to 2 ft. of unfilled opening below the stope back.

Fill Is 70% Solids

Tailings are delivered to the stope through a pipeline from the surface, as a fluid pulp of sand-slime-water, at about 70% solids. As soon as the excess water is decanted from the top of the fill, and/or seeps through the end-wall, the sand-slime sediment consolidates and provides firm support for the stope walls. Consolidation of the sediment from the pulp is rapid: a not unusual practice is to blast a round of ore onto the fill at the end of the same work shift during which it is poured. By the end of the following shift, the sand serves as an ideal slusher floor without planking. A little broken ore is left covering it until the horizontal cut has been completed. In the final cleanout a few inches depth of sand is scraped in to recover the valuable fines from the blasted ore — old tailings are washed through the mill at little additional cost.

Preparation of the sand-slime pulp at Dayrock is intermittent, in batches of about 60 tons (dry weight), each of which is accumulated and dewatered in the tank on the surface. The batch is stirred to a uniform pulp and is poured rapidly through an open-ended 3-in. pipe line into the stope. Accumulation of a batch requires eight hours, mixing requires one-half to three-quarters of an hour and discharge of a batch into the stope requires from one-half to three-quarters of an hour. The volume of each batch is sufficient to fill a horizontal cut in a narrow stope, but a wide stope may require from two to six batches; mining may proceed at the opposite end of the stope during whatever period is required for additional filling. A batch system of preparation and delivery of the sand fits readily into the cut-and-fill stoping cycle, whereas a continuous-fill system, such as is used at a number of mines, is not so readily adapted.

Several changes in layout of the stopes are made in converting from waste-fill to sand-fill. The central stope-raise, which formerly provided the down-chutes and manway (Fig. 1), is eliminated as unnecessary. Preliminary development for a sand-fill stope (Fig. 2) is simple, merely a through-raise to the level above; from it a double-ended stope extends half-way to the next through-raise on each side. Ends of a stope are established (1) by reaching the side of a previously-completed stope, (2) by reaching a geological break or impoverished area in the vein, or (3) by reaching a pre-determined limit of length for the stope block.

The initial, or bottom, cut of a sand-fill stope usually is a slusher-driven sub-drift, 10 to 15 ft. above the top of the haulage-level drift. Thus the floor of the sub-drift will hold the first pour of fluid sand-fill without danger of leakage, whereas the initial lacing and sealing of a stope that rises directly above a timbered drift requires much more work and materials. Recovery of the small pillar of ore underlying the sub-drift is postponed until the stope from the next lower level nears completion; whereupon, the pillars below and above the main level may be mined with a single retimbering of the level, or with its abandonment in retreat. If the sub-drift is in wide ore of steep dip, old timber is strewn along the floor before filling, to tie the sand mass together and facilitate future mining of the underlying pillar from below. No such matting is needed in ore of dip flatter than 60 deg.

Sand Fill Aids Ventilation

Ventilation in the Dayrock mine has been greatly improved through adoption of sand-fill stoping. Air currents are channeled through only half the number of open raises; the timber is completely buried or is kept permanently wet and therefore does not rot and emit gas; the filling of flat-dipping stopes prevents accumulation of contaminated air. Moreover, moisture from the sand is absorbed upward into the freshly blasted piles of stope ore in which the potential

ore dust is largely suppressed before slushing commences on the following work shift. Formerly, much dust was contributed to the ventilation current during the filling operation by dumping and spreading the development waste across the stope floor, in addition to the dust raised by slushing broken ore. At places where permanent ventilation ducts are needed for subsequent stope blocks, sectional metal vent tubes or wooden-box ventilation stacks may be carried up the dip, embedded in the sand at the end of the stope, the top of the uppermost section buried a foot below the current slushing floor.

Sand-fill stoping has proved to be very flexible for extracting irregular orebodies at Dayrock. Waste pillars and irregular, low-grade stope ends now commonly are left unmined. Previously many of these were mined by waste-fill stoping in order to maintain access across the stope back between the two raises. Fig. 3 illustrates the irregularity of stope outlines that has resulted from the more flexible stoping.

Irregularity of the ore requires a short vertical interval between mine levels where waste-fill stoping is to be used: development by levels at 100-ft. lifts yields a greater number of complete quadrilateral ore blocks than development at 150-ft. lifts. In contrast, sand-fill stoping permits attack of a small block of ore exposed only along the side of a development raise, irrespective of the length and vertical extent of the block. As a result, the 150-ft. level interval now may be used at a considerable saving in development expense. Regularly spaced development raises should be driven through potential ore blocks in which the showing is substandard at the start.

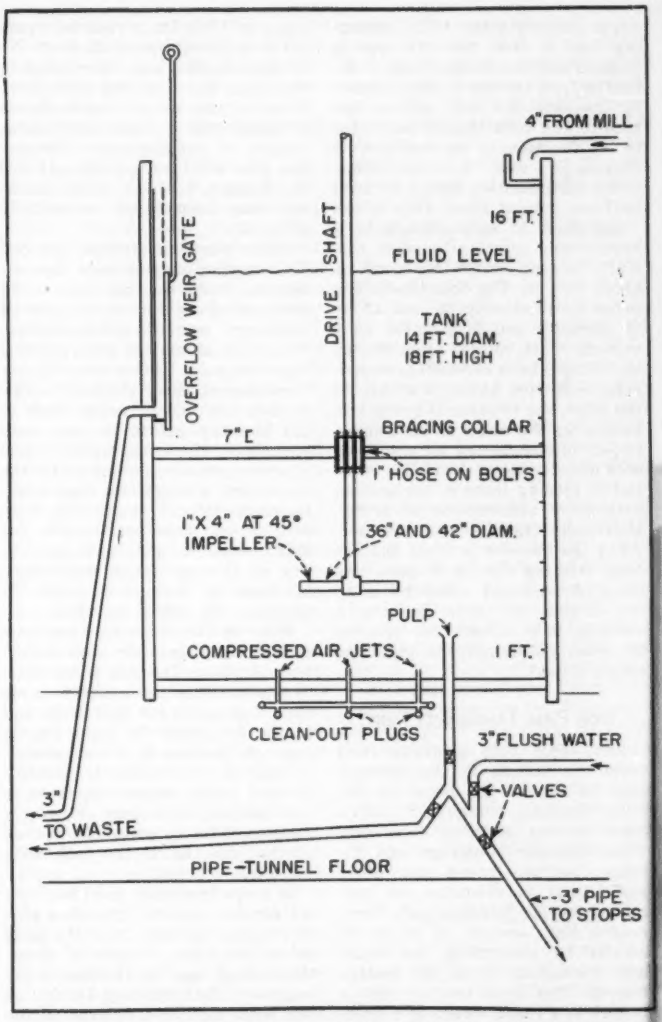


FIG. 4. MILL TAILINGS are pumped in batches to this tank. Each batch is allowed to settle. Minus 325-mesh particles escape through overflow weir. Then remainder of batch is agitated and flows by gravity through iron pipes to stopes underground.

Character of Mill Tailings

Principal minerals comprising the flotation tailings are quartz, sericite and siderite. Minor amounts of galena, pyrite and sphalerite also are present plus about 4 lb. of metallic iron per ton of tailings, introduced during grinding. Size of particles in the tailings depends on the nature of the ore and the type of grinding and classification employed. Success of the sand-fill plant depends on ability to utilize the tailings during periods of coarse or of fine grinding, rather than on the average or optimum product. The period of sand filling at Dayrock has embraced several changes in milling circuits and a wide variation in tailings sizes, as indicated in the table on page 94.

Batch Accumulation and Agitation of the Mill Tailings

Despite wide variations in sizing, almost the entire bulk of the flotation tailings, at 20-25% solids, is pumped from a collection hopper at the mill tail race through a 4-in. pipe line to a settler-agitator tank which is situated 550 ft. distant and 50 ft. higher, above a mine entry. The tank is of 2⅝-in. wood-stave, 14 ft. in diameter by 18 ft. deep. It serves first for the accumulation, by quiet settling, of a batch of tailings from which the excess water together with about one-third of the minus 325-mesh particles escape through an overflow weir and return to the tail race. Elevation of the weir in the tank may be adjusted to control the volume of the batch accumulated (Fig. 4). When the tank becomes filled with sediment to the desired

depth (usually about 12 ft.), pumping into it from the tail race is stopped and the excess water is decanted from the top of the sediment by lowering the weir gate a few inches. The tank then is converted to its function as an agitator, to thoroughly mix the sand-slime-water accumulation into a batch of uniform pulp at about 70% solids.

Agitation is accomplished by a horizontally rotating impeller, centrally located in the tank, 40 in. above bottom. The four-bladed impeller is alternately 36 and 42 in. in diameter and is mounted on a vertical shaft, rotated from the top at 108 rpm by a reversible, wound-rotor induction motor of 40 hp. At the start, the impeller is firmly embedded in the mass of sand-slime, so jets of compressed air are liberated directly below the blades to assist in freeing them in conjunction with brief applications of power, alternately forward and reversed. After the impeller is freed and has been rotating for 10-30 min., the mass of sand and water takes up the motion and soon becomes a swirling pulp suitable for pouring by gravity through the pipe line into a stope.

Iron Pipe Transports Pulp

Sand-slime pulp is transmitted from the bottom of the agitator tank to any of the stopes in the mine through trunk and branch lines of 3-in. standard iron pipe with Victaulic couplings and fittings. Neither valves nor other restrictions in diameter are permitted in the underground lines; branch lines are put in or out of service by uncoupling the trunk and recoupling it to the desired branch. The head end of such a branch is a radial sweep or a gradual bend, shaped with an hydraulic pipe bender. When not in use, the branch end is left hanging alongside of the trunk line. The pipe lines of the Dayrock sand-fill system now aggregate 4,345 ft. in length. The longest individual line is 2,440 ft. from the tank to the stope.

As much of the pipe line as possible is kept down-grade; where a reversal to up-grade is necessary, the up-grade section should be prolonged as far as possible, to reduce the number of sag points where the line should be emptied after flushing, for fear that a build-up of sediment may plug the line. To date, the flattest hydraulic gradient used at a considerable distance from the tank has been minus 7 deg., a 1,500-ft. horizontal reach after a 240-ft. vertical drop. No actual difficulty was experienced in this case, but since the rate of delivery of pulp was noticeably slower it seemed wise to run an extra-large volume of flushing water through the pipe after each batch. At 400 ft. distance, a minus 3-deg. gradient has been used successfully (Fig. 3).

Upon reaching a stope, the last few lengths of sand pipe line extending from the manway across the back of the stope to the point of discharge are of quick-coupling, 4-in. O.D. aluminum pipe, propped high on poles. After the fill has been poured, this light-weight pipe is detached and is pulled back to the manway before blasting may commence. Since only a foot or two of space remains unfilled under the stope back, a heavy iron pipe would be more difficult to retract. Fire hose is considered undesirable for this function because kinks developing in it may cause momentary blockage of flow and result in plugging the entire pipe line.

Wear in the trunk pipe line now is scarcely discernible after 20,000 tons of filling. The lack of abrasion is attributed to the lubricating effect of slime on the pipe walls and to the fact that the pulp travels through the pipe at a low velocity because of its considerable viscosity at 70% solids; moreover, there is little settling of coarser or heavier sand particles to scour the bottom of the pipe, as is the case with more dilute pulps.

In a few instances, sand has been delivered to a stope through a pipe line rising upward from the level below the stope. At one of these, the vertical head on the line at the bottom of the stope was 440 ft.; as the stope advanced upward to the level above, the head diminished to 360 ft. No difficulty was encountered and the only special precaution taken was to break the pipe line at the lowest point after the flush-out, to allow all of the water and possible sediment to drain out.

How Stopes Are Prepared

After the broken ore has been cleaned out and sampling, etc., completed, the floor and walls are examined for cracks, which are plugged with paper, excelsior, old burlap or with sand from a previous filling. The chute is raised to the elevation of the floor for the next cut and the side toward the open stope is laced tightly with 3x12-in. lagging, covered with old burlap, to form a vertical bulkhead or dam to restrain the fluid in the stope cut until it consolidates. If the far end of the stope is solid ground lacing is not needed, but if it is connected to another raise it must be laced. Where irregular and broken ground is exposed to the fill in a position difficult to lace it may be covered by an earth-fill dam of sand or waste scraped over or against it. Dams to cover such areas should be carried somewhat higher than the on-coming pour to prevent leakage. Timber to support bulkheads should be firmly headed and collar-braced to withstand hydrostatic pressure until the fluid fill consolidates.

The problem of impounding sediment in a stope is similar to that in a surface tailings pond except that it is much easier as a result of the progressive drying and compacting of the bottom layers of fill in the stope as the excess water seeps through the end bulkhead. The impervious floor of a tailings pond keeps the sand continually saturated. The bottom may become fluid again during a rainy season from injection of springs of water under artesian pressure from the ground below.

Two-Way Speaker Employed

Inter-communication between the operator of the sand tank at the surface and the "sand herder" in the stope is very desirable during the pouring of a batch of fill. Several methods have been tried—the best is a two-way public address system, with a portable speaker-box for the stopes connected by an extension cord to a trunk cable paralleling the sand pipe line.

A 30-sec. run of clear water to flush the pipe line precedes and follows the discharge of a batch of sand-fill into a stope. This water from flushing, plus about two-thirds of the total water contained in the pulp at 70% solids, is decanted from the surface of the fill. Removal of the water permits the sand-slime mass to harden promptly and avoids breaks in the lacing, which may develop in the lower part of the bulkhead from the hydrostatic pressure of a column of water that has worked down along a crack from the surface of the fill. When the dense pulp enters such a channelway, sediment fills and chokes off the opening against further pressure from the shallow pool of fluid above.

In placing the sand-fill, the pulp is discharged from an open-ended

pipe at the end line of the stope. From this point of discharge the sediment builds a flat alluvial cone, which slopes back toward the central through-raise and is arrested by the vertical bulkhead at the side of the ore chute. As the motion of the pulp slows, water starts to segregate from it and forms a pond which rides above the heavier sediment and ends against the bulkhead at the chute. Two simple devices are in use to decant the water from the top of the fill as it accumulates. The first, and more generally used, is a simple drainage board incorporated in the vertical bulkhead—one of the bulkhead planks is perforated with 1-in. holes, previously bored with a power-borer on the surface, in rows of 2- to 3-in. spacing. Between rows of holes two longitudinal fins are nailed, on the side toward the fill, to keep the burlap filter cloth from being pressed too tightly against the holes and blinding them. Water above the level of sediment runs freely through the burlap, out of the holes and into the chute; below the sediment level residual water in the fill filters out slowly through the drainage board and seeps through other cracks in bulkhead.

"Mousetrap" Decants Water

A similar but more complex device for decanting the water from the top of the fluid sand-fill is the "mousetrap." It is a filter and drainspout combined, a box of 1x6-in. lumber perforated with 1-in. auger holes, in sections about 6 ft. long which are joined to form a continuous stack embedded in the fill. Burlap filter cloth is wrapped around the box over 1-in. longitudinal fins that space the burlap away from the holes to prevent them from becoming blinded as the fill presses the burlap against the box. The "mousetrap" is placed vertically (or updip) in the space to be filled, a few feet inside of the end bulkhead at the side of the ore chute. From the bottom of the drainage stack, a short horizontal section of non-perforated box carries the water through the bulkhead and discharges it into the ore chute. During a pour of sand-fill pulp, the sediment impounds against the burlap and only water filters through and runs down the box. Primary function of the "mousetrap" is to provide for decantation of the pool of water which accumulates against the bulkhead, on top of the sediment. This water is drawn off above sediment level, often by lowering the burlap covering to allow a more rapid flow of the water through the holes, then raising and re-wrapping the burlap around the box as the sediment level creeps upward, never permitting more than a few inches of water to accumulate.

Irregular stopes commonly contain unmined vein pillars and occasionally underhand excavations; either of these may develop temporary barriers to the drainage of excess water from the top of the fill until several additional batches have been poured and the water finally is floated above the crest of the barrier and runs over to the bulkhead whence it may be drained. This generally gives no trouble, although water should not be allowed to stand on newly-poured fill if it has access to cracked walls, old timber or other imperfections in the lacing of the stope. Elsewhere, after the sand-fill has been drained of excess water, it consolidates, compacts slightly through shrinkage, and thereupon becomes practically impervious to penetration by water from above. For example, water in a drainage ditch may be led across the top of a sand-fill stope without loss and pools of water will stand under dripping fissures without softening the sand mass below.

After consolidation and compaction the fill permanently retains about 10% moisture by "capillarity" which contributes a desirable cohesion and in time promotes chemical cementing between grains. The lack of porosity of the sand-slime fill is ascribed to a tight pack of interlocking grains consolidating from dense pulp, as opposed to a loose pack of classified grains that settle through water. A porous type of sand-fill carries a continual threat of break-away. The compact, impervious type of fill cannot again become fluid without expanding to accept additional water—pressure from the stope walls and from the superior gravity of sand over water prevent re-pulping of the fill.

Getting Rid of Leakage

During each filling of a stope, a small amount of slime and sand may leak through the lacing and run down to the main level below, together with fines washed from the chute by the flushing water. This spillage may amount to a few shovel-fulls or to several tons; the simplest way to control it seems to be to drop a low barrier of boards or muck across the drift on the downstream side of the chute to impound spill and keep it from choking the drainage ditch or possibly reaching the pump sump. Settling traps are desirable at all mine pump sumps and especially are needed where sand-fill is used. No unusual pumping problems or excessive wear on the pump impellers have developed at Dayrock since adoption of sand-fill stoping.

How Big Should Tank Be?

Some of the considerations which led to selection of the size of tank for the Dayrock installation are: (1) About 50% of the total mill tailings will provide sufficient fill for stoping requirements because considerable volumes are left unfilled (drifts and raises); because local development waste will contribute part of the filling; and because of the increased volume of the finely pulverized ore. (2) About 80% of the solids in the mill tailings will be retained in the tank during the period of accumulation. (3) A tank sufficient to accumulate 10 hours of mill tailings is capable of two batches per 24 hours, timed to the regular two shifts of mine operation. A somewhat larger tank, sufficient to accumulate 16 hours of mill output of tailings is capable of operation either at two batches, or at one larger batch per 24 hours. (4) Batches of more than 16 hours' accumulation tend to consolidate in the tank and are difficult to agitate. (5) A two-tank plant would be needed only if many old stopes were to be filled in addition to current stopes.

Cost of Filling Stopes

Cost of filling an average Dayrock stope by each of three methods is given in an accompanying table. For this purpose, the sand is classed as "no cost" material at the mill and the waste as "no cost" when loaded in cars at the development heading; the quarried waste carries the cost of excavation in a development heading run primarily to provide stope filling. (The cost is based on a nominal miner's wage of $12.45 per day, which actually averages $15.86 in payroll expense.)

Acknowledgments. The writers are indebted to Henry L. Day, President, Day Mines, Inc., for his part in initiating the sand-fill program at Dayrock and for permission to publish this paper. R. J. Horsman, Chief Engineer; L. A. Grant, General Mills Superintendent; and Fred Torkelson, Mine Foreman, also have assisted with the project.

WASHINGTON IMPACT

Minerals Authority Still Divided—Protracted Copper Shortage Seen—Broad Subsidy Power in New Defense Act—New Priority System

THE SELECTION of Jess Larson, head of General Services Administration, to organize a new minerals expansion and procurement agency brings an able and energetic administrator into the mobilization team. Whether it will untangle the crossed lines of authority which have hampered the minerals expansion programs remains questionable.

One thing is sure. There is nothing in the delegation of authority, as announced by President Truman, which clears up the confusion. On the contrary, it leaves all of the sources of confusion intact.

The question, then, is whether Jess Larson can cut across red tape and divided authority with the power of personality and the prestige of his new position. If he can, then minerals expansion will actually have the centralized head the industry has been hoping for. If he cannot, then it is hard to see how the new setup will be any superior to the one that bogged down.

This becomes clear in an examination of the authority to be granted Larson as head of the new Defense Materials Procurement Agency. He will get three functions formerly held by Dr. James Boyd as head of Defense Minerals Administration. These are: 1. responsibility for recommending expansion projects for quick tax amortization; 2. initial approval of purchase contracts before they go to GSA for final action; 3. initial approval of loan applications.

Larson's new organization will handle these functions instead of DMA. But Larson must still do what DMA also had to do. He must go to DPA for final approval of tax amortization and loans, and to GSA for the final say on purchase contracts.

The responsibilities of DMA were greatly reduced in the Truman order, but they still are important. It will continue to serve as claimant agency for the mining industry before NPA, requesting the necessary machines and supplies to expand operations. It will also administer the exploration aid program. It appears likely that DMA may retain the job of estimating production and consumption needs, with ideas for closing the gap; in short, what the bureaucrats call programming. If it does keep this function, it will be because Larson has no desire to set up his own organization of experts in the mining field.

The situation boils down, then, to the addition of a new agency in the already confused minerals picture. DMA retains important responsibilities. Some have been taken on by the new DMPA. DPA retains its final say over some phases of the program. The same for GSA.

Congressional critics of the minerals expansion program intend to give Larson every chance to get the stalled programs going, but they wonder whether the President has given him enough real authority.

Schroeder Heads DMA

Dr. W. C. Schroeder, who was named head of DMA to replace Dr. Boyd, is a chemical engineer whose experience has been in fuels, particularly the USBM synthetic fuels program, which he has headed in recent years. This program employs about 1,000 persons and has experimental plants in operation at Louisiana, Mo., and Rifle, Colo. The last three secretaries of the Interior have pushed this particular program. With all of them, Dr. Schroeder made a good impression as an administrator. His friends say this is why he got the DMA job when Secretary Chapman looked around for a successor to Dr. Boyd.

Dr. Schroeder plans no personnel changes. Indeed, he is hoping that the staff brought together by Dr. Boyd will sit tight, and that it can be expanded by experienced mining men.

He is particularly pleased with the way the exploration program was rolling when he took over, pointing out that there had been little criticism of this part of DMA's work. The first $5,000,000 for exploration grants will be used up by the end of the month. It is understood that an additional $5,000,000 will be made available, as originally planned.

At the same Dr. Schroeder was named acting administrator of DMA, Chapman appointed him assistant director of the Bureau of Mines. Dr.

EXPLORATION CONTRACTS APPROVED BY DMA

(Supplementing List in August Issue, p. 88)

Company	Location	Mineral	U. S. Gov't Part %	U. S. Gov't Part Amount
Zenda Gold Mining Co.	Seward Pen., Alas.	Tin	90	$ 54,000
Arkansas Manganese Co.	Polk Co., Ark.	Manganese	75	15,000
Eureka Tungsten	Boulder Co., Colo.	Tungsten	75	10,500
Cold Spring Tungsten, Inc.	Boulder Co., Colo.	Tungsten	75	158,310
Tom C. Stanford	Boulder Co., Colo.	Tungsten	75	7,500
East Ridge Co.	San Miguel Co., Colo.	Lead—Zinc	50	30,090
Cement Creek Leasing Co.	San Juan Co., Colo.	Lead—Zinc	50	2,425
Erickson & Baer	Dolores Co., Colo.	Lead—Zinc	50	1,500
Moreno-Cripple Creek Corp.	San Juan Co., Colo.	Lead—Zinc	50	38,000
Bachelor Dev. Co.	Ouray Co., Colo.	Lead—Zinc	50	36,252
Bonita Mining & Dev. Co.	San Juan Co., Colo.	Lead—Zinc	50	9,000
Tungsten Mining Co.	Boulder Co., Colo.	Tungsten	75	7,500
Cherokee Mines	Larimer Co., Colo.	Uranium	90	12,600
H. L. Miller & L. Warnken, Jr.	Inyo Co., Calif.	Tungsten	75	45,000
G. McGuire Pierce	Fresno Co., Calif.	Tungsten	75	11,250
Petroleum Inv. Trust, Ltd.	Kern Co., Calif.	Tungsten	75	10,527
The Philip Carey Mfg. Co.	Trinity Co., Calif.	Asbestos	90	71,550
Cordero Mining Co.	Santa Clara Co., Calif.	Mercury	75	150,621
Altoona Quicksilver Min. Co.	Trinity Co., Calif.	Mercury	75	67,839
Paymaster, Inc.	Blaine Co., Ida.	Lead—Zinc	50	21,500
Highland Surprise Con. Min. Co.	Shoshone Co., Ida.	Lead—Zinc	50	100,000
L. S. Heller	Valley Co., Ida.	Lead—Zinc	50	300
J. P. Holtermans & Chad Spr.	Custer Co., Ida.	Fluorspar	50	3,897
Idaho Mining Co.	Shoshone Co., Ida.	Lead—Zinc	50	61,869
Blazard and Shirts	Custer Co., Ida.	Lead—Zinc	50	4,200
The Florence Co.	Cascade Co., Mont.	Lead—Zinc	50	20,690
Golden Messenger Corp.	Jefferson Co., Mont.	Lead—Zinc	50	30,938
Bennett Mining Co.	Cascade Co., Mont.	Lead—Zinc	50	50,000
Peru Mining Co.	Grant Co., N. M.	Zinc—Lead	50	112,500
Piedmont Minerals, Inc.	Caston Co., N. C.	Mica	90	4,581
Bess Gaston Mica Co., Inc.	Gaston Co., N. C.	Mica	90	4,950
Ernest Mica Co., Inc.	Mitchell Co., N. C.	Mica	90	1,170
Gaston Strategic Min. Co., Inc.	Gaston Co., N. C.	Mica	90	5,040
Harold E. Enloe	Macon Co., N. C.	Mica	90	1,800
Harold E. Enloe	Macon Co., N. C.	Mica	90	2,934
Pitt Mica Corp.	Macon Co., N. C.	Mica	90	2,372
Keenan Properties	Lawrence Co., S. D.	Tin, etc.	90	90,000
Gladys Wells	Custer Co., S. D.	Mica—Beryl	90	3,600
Black Hills Keystone Corp.	Pennington Co., S. D.	Mica—Beryl	90	12,600
King, Scott & King	Bradley Co., Tenn.	Cobalt—Manganese	90	6,768
Nasburg & Hallenius	Stevens Co., Wash.	Lead—Zinc	50	6,768
Amer. Zinc, Lead & Smelt. Co.	Pend Oreille Co., Wash.	Lead—Zinc	50	60,000
Goldfield Consol. Mines Co.	Stevens Co., Wash.	Lead—Zinc	50	11,527
G. O. P. Antimony	Okanogon Co., Wash.	Antimony	75	7,313
Calumet & Hecla Cons.	Lafayette Co., Wis.	Lead—Zinc	50	79,259

Boyd was not removed as director of the Bureau of Mines. He told a staff meeting shortly after the DMA shake-up that he would remain in that post.

At least one Congressional committee is looking into charges that Dr. Boyd was removed as DMA head because he opposed putting the USBM synthetic fuels program into the commercial phase at this time. This may well have been a source of friction, but it's not the whole story. Tension between Chapman and Boyd had been growing for months, regardless of the synthetic fuels program.

Long Copper Shortage

Controls officials see no end to the copper shortage, whereas they are willing to talk about the middle or the end of 1953 as the end of controls over steel and aluminum. Both Chief Mobilizer Wilson and his top lieutenant, Manly Fleischmann, have mentioned 1953 as the year to end most controls. But Fleischmann added that they simply cannot foresee the time when the supply of copper would fulfill demand. The implication is plain: controls over copper as long as the international tension lasts or until substantial additions to productive capacity balance supply and demand.

We're not even maintaining the

(*Continued on page 152*)

Brief, But Important

PRICE CONTROLS—OPS ended price controls over raw asbestos, beryllium ores, chrome ores, cobalt ores and metal, columbite-tantalite, natural graphite, kyanite, manganese ores, acid grade fluorspar, and domestic mercury.

LEAD DUTY—The House voted to suspend import duties on lead and lead products until March 31, 1953. Under the bill, the President must restore duties if the average *E&MJ* market price of lead for a calendar month goes below 16⅞¢ per lb. New York. The Senate is expected to concur.

ACCESS ROADS—DMA has approved 11 projects for access roads, rejected six and is studying 52 more. Of the 11 approved, seven must wait for appropriations for the 1952 fiscal year. One project has already been completed—a road into an antimony-tungsten development at Stibnite, Idaho.

FREIGHT ABSORPTION — Senate (only) has passed a bill permitting freight absorption to meet competition.

FREIGHT-RATE HIKE—ICC has approved freight rate increase of 9% in Eastern territory and 6% elsewhere and interterritorially. Special provisions apply to coal, coke, iron ore, phosphates, potash, and lumber. These rates supersede smaller increases of March 12, 1951.

LABOR THIS MONTH

Joseph M. Gambatese, McGraw-Hill Washington News Bureau

MINING DEFERMENTS? There's a chance for them. This is happening: Expanded production goals for copper, lead, zinc, and iron have been projected through 1955. From them, manpower experts are figuring how much more labor will be needed. They think the figures will make a strong case for deferment of metal miners.

PRECEDENT: Some steps already have been taken to ease shortages of particular types of workers. Draft boards have been alerted to "minimize" the induction of irreplaceable skilled machine operators and to give serious "consideration" to deferring engineers and draftsmen. Selective Service also wants to defer machine-tool industry apprentices. Of course, reservists will get similar consideration at Defense Department.

SOLDIERS ON PART-TIME: If you're near a military installation, the local commander can authorize part-time employment of military personnel if it doesn't interfere with military duties. You must be in an area of labor shortage.

USE OF WAGES: Government policy is to permit use of above-ceiling wages for manpower reasons only as a last resort. Wilson has issued this directive: Manpower and procurement officials both must report on other steps taken to get manpower before Wage Board may consider a wage increase.

WAGE TREND: Basic wage policy is all set. Wages can rise with the cost of living — if the boss agrees. That goes for everybody. A union contract or escalator clause is not necessary. Johnston approves this until next March.

DEFERRED INCREASES: They are approved, too, if promised before the wage-price freeze of Jan. 25. Moreover, they must be reasonable and not unstabilizing.

MERIT RAISES: These are not limited to cost-of-living, either. But there are restrictions. You must follow a plan. You may not go higher than your highest rate for the job. It's all spelled out in WSB regulation as amended July 27 and August 17.

BONUS PLANS: Bonuses paid once or twice a year, such as profit-sharing and Christmas bonuses, may be paid again if you adhered to your practice before the wage-price freeze.

FRINGES: Policies on various fringes, like pensions and welfare plans, severance pay, vacations and paid holidays, are still to come.

CHANGE AT WSB: With most wage-control policies developed, WSB chairman George Taylor considers his job done, returns to University of Pennsylvania. Vice chairman Nathan P. Feinsinger takes over as chairman. Feinsinger is particularly adept in labor disputes, of which WSB may get many.

FEINSINGER IN STEEL: If steel negotiations this winter wind up at WSB—as did the steel union's dispute at Garfield smelter—Feinsinger will feel right at home. He was chairman of Truman's fact-finding panel in the steel strike of 1946.

OVERTIME PAY STAYS: It's now official. Mobilizer Wilson has decided that to drop premium overtime pay would hurt defense.

MINE-MILL HANGS ON: We've reported before on Mine, Mill and Smelter Workers' success in fighting off raids by CIO, AFL and other unions. We can now give you exact figures from NLRB records on elections involving Mine-Mill since expulsion from CIO in November, 1949:

MINE-MILL won 36 elections, 30 of them in competition with other unions. It lost 12 to CIO, 10 to AFL, 14 to International Association of Machinists (now AFL), and 1 to an independent. In 6, employees voted for "no union."

In 4 decertification polls to remove Mine-Mill as bargaining agent, Mine-Mill lost all 4.

AFL ACTIVE: AFL unions have become more active in metal mining. They were on the ballot in 24 of the NLRB polls. Metal trades unions are making headway against some Mine-Mill locals in Anaconda.

AFL COOLS OFF ON CIO: You can expect the jurisdictional feuding to intensify, with the AFL playing a larger role, now that the AFL is breaking off joint relations with the CIO in the United Labor Policy Committee. Politically, the Democrats stand to suffer by this sudden development.

CONTROLLING COMMIES: Senator McCarran has introduced an amendment to his Internal Security Act which would:

1. Make it unlawful for a Communist to become an officer of or represent a labor union.

2. Deny bargaining privileges to any union represented by a Communist.

3. Permit an employer to fire any person who is a member of any subversive group or who refused to tell a Congressional committee whether he is a member of one.

(See p. 101 for more Labor News)

MARKETS—Trends and Prices (*Continued from page 69*)

Manganese Ore Supply

Imports of manganese ore containing 35% or more Mn totaled 158,866 short tons in April, which was slightly below the average of the three preceding months. Of the ore imported during April, India supplied 42%; Gold Coast 31%; Union of South Africa 12%; and Cuba 7%. Mexico, Turkey, Belgian Congo, Chile, Peru, French Morocco, Philippines and Iran contributed a total of 8%.

Total consumption of metallurgical manganese ore in the United States during April was estimated by the Bureau of Mines at 152,424 tons.

Industry stocks of manganese ore at the end of April totaled 716,231 tons, a drop of 3% from March.

Domestic mine shipments, general imports, and exports of manganese ore for the 1947-50 period and the first four months of 1951, in tons:

	Domestic Mine Shipments	General Imports		Exports		Net Supply
		Ore	Ferromanganese (a)	Ore	Ferromanganese (a)	
1947	131,627	1,541,818	156,760	10,075	38,884	1,781,246
1948	131,100	1,256,597	195,360	9,236	39,175	1,534,646
1949	126,100	1,544,526	130,028	5,033	13,254	1,782,367
1950	139,000	1,837,950	221,684	8,962	1,160	2,188,512
1951:						
January	9,000	167,358	27,300	633	130	202,895
F bruary	9,200	169,165	21,200	287	22	199,256
March	9,300	162,012	17,200	973	70	187,469
April	9,600	158,866	19,500	715	24	187,227

(a) In terms of ore.

Official London Prices

Consumers in the United Kingdom obtain copper, lead and zinc at prices named by the British Ministry of Metals. Delivered prices in effect as July ended were as follows:

	Per Long Ton £	s.	d.
COPPER:			
Electrolytic, high conductivity	234	0	0
Fire refined, high conductivity	234	0	0
Fire refined, high grade	233	10	0
Fire refined, min. 99.7 percent	233	0	0
Fire refined, min. 99.2 percent	232	10	0
LEAD:			
Soft, foreign duty paid	180	0	0
Soft, Empire	180	0	0
English, refined	181	10	0
ZINC:			
Foreign (G.o.b.) duty paid	190	0	0
Domestic (G.o.b.) duty paid	190	0	0
Prime Western and debased	190	0	0
Refined and electrolytic	194	0	0
Minimum 99.99 percent	196	0	0

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York unless otherwise stated

MISCELLANEOUS METALS

August 31, 1951	
Aluminum, ingot, 99 plus percent, lb. (base price)	19c.
Antimony, spot, lb., 5 tons and up but less than carload in cases	45,350
Bismuth, ton lots, lb.	$2.25
Cadmium, commercial sticks, delivered, lb.	$2.55
Calcium, lb., ton lots, 98 percent, cast	$2.05
Chromium, 97 percent grade, lb., contract	$1.07
Cobalt, 97 to 99 percent, per lb.	$2.10
Indium, troy oz.	$2.25
Nickel, cathodes, lb., f.o.b. Port Colborne (a)	56¼c.
Magnesium, 99.8 percent, carloads, lb., producer's plant, Freeport, Texas	24¼c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots) troy oz.	$90.00
Quicksilver, flask of 76 lbs., 25 flasks or more	$195 @ $200
Selenium, 99.5 percent, lb.	$3.00 @ $3.50
Silicon, minimum 97 percent, carloads, lb	20c.
Tellurium, lb.	$1.75
Thallium, 100 lb. or more, lb.	$12.50
Titanium, 96 to 98 percent, lb.	$5.00

(a) Includes U. S. duty.

METALLIC ORES

Beryllium Ore, imported, 10 to 12% BeO, per unit	$33.00 @ $36.50
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry	
44% Cr_2O_3, no ratio	$27.00 @ $28.00
48% Cr_2O_3, 3 to 1 ratio	$43.00 @ $53.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$8.70
Mesabi bessemer	$8.45
Mesabi, non-bessemer	$8.30
Lead (Galena), 80 percent, Joplin, Mo., ton	$218.42
Manganese Ore—Per long ton unit of Mn basis 48 percent manganese, nearby positions, subject to premiums and penalties, $1.25 @ $1.30, c.i.f. U. S. ports, duty extra. Long-term contract quotations wholly nominal and matter for negotiation.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	60c.
Tantalite, 60% concentrate, per lb.	$2.00 @ $2.50
Tungsten Ore, per unit of WO_3	
Foreign, 60 percent, U. S. equivalent, duty extra	(a) $65.00 @ $66.50
Domestic, scheelite, 60 percent f.o.b. mine	$65.00
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	31c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton	$115.00

(a) F. o. b. port of shipment.

METALLIC COMPOUNDS

Arsenious Oxide (arsenic trioxide) lb., in bbl. carload lots delivered	6½c.
Cobalt Oxide, 72%, metallurgical grade, per lb. of Co	$2.25
Copper Sulphate, 100 lb.	$8.95

ALLOYS

Beryllium Copper, 4 percent Be, per lb. of alloy, 5 lb. ingot	$1.56
Ferrochrome, 65 to 69 percent, per lb. of Cr contained	21¾c.
Ferromanganese, 78 to 82 percent, gross ton, seaboard	$185.00
Ferromolybdenum, 55 to 65 percent Mo. lb. of Mo. contained	$1.32
Ferrosilicon, 50 percent, per lb. of contained Si	12.4c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$5.00
Ferrovanadium, per lb. of V delivered	$3.00 @ $3.25
Silicomanganese, max. 1½ percent carbon, per lb. contracts	9.9c.
Spiegeleisen, per long ton, 19 @ 21 percent grade	$75.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds), ton:	
Crude No. 1	$960 @ $1,500
Crude No. 2	$595 @ $900
Spinning fibers	$275 @ $475
Shingle fibers	$123 @ $170
Paper stock	$85 @ $119
Waste	$63 @ $70
Shorts	$30 @ $63
Asbestos, Vermont, f.o.b. Hyde Park:	
Spinning fibers	$279.50 @ $302.00
Shingle stock	$135.00 @ $162.00
Paper stock	$81.50 @ $115.00
Waste, stucco or plaster	$71.40
Rejects or shorts	$34.00 @ $63.00
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$13.00 @ $13.50
Missouri, 93 to 94 percent $BaSO_4$, per short ton	$9.25 @ $9.50
Bauxite, long ton, f.o.b. point of shipment:	
Domestic, crude, 50 to 52 percent (not dried)	(a) $4.50 @ $5.50
Domestic, chemical, 55 to 58 percent	(a) $8.50 @ $9.50
Domestic, abrasive, 80 to 84 percent	(a) $18.00 @ $18.50
China Clay, f.o.b. mines, ton:	
Georgia, filler and ceramic grades	$8.50 @ $9.50
North Carolina ceramic grade	$20.25 @ $22.25
Feldspar, bulk ton:	
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50 @ $22.25
Glass feldspar, white, 20 mesh	$11.75 @ $12.50
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois, 70% effective, CaF_2, ton	$43.00
Acid 97% concentrate, bulk, ton	$50.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 @ $14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington	$36.30
Mica—Domestic, f.o.b. mines. Punch 12 to 22c. per lb. according to size and quality. Sheet, clear, 1½ x 2 inch, 80 to 85c.; 2 x 2 inch, $1.10 to $1.20; 2 x 3 inch, $1.50 @ $1.60; 3 x 3 inch, $1.80 @ $1.90; 3 x 4 inch, $2.20; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton. Scrap, $32 and up.	
Ocher, Georgia, ton, in sacks	$24.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	Not Quoted
Sulphur, Texas, mines, long ton	$22.00
Talc, f.o.b. works, ton:	
New York, purified	$18.50 @ $20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$30.00

(a) Nominal.

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces	$52.00
Steel, f.o.b., Pittsburgh billets, net ton	$56.00
Structural shapes, 100 lb.	$3.65

THIS MONTH IN MINING

Struggle for Control Between Mine Labor Unions Catches Operators and Vital Productions in Line of Fire

JOSEPH M. GAMBATESE
McGraw-Hill Washington Bureau

METAL MINING seems to be entering a new era in collective bargaining.

For the first time, the country in August faced the threat of practically a complete stoppage of copper production by big, strong unions. Lead and zinc ran into labor difficulties, too.

This was no accident. It's part of a plan. For the industry, it means more labor trouble ahead, even after the current situation clears up.

What's happening is this: Two big unions are fighting for bargaining control in the industry—the powerful CIO United Steelworkers of America trying to take over and the Communist-line Mine, Mill and Smelter Workers, ex-CIO, trying to hang on.

So far the steelworkers have made a poor showing toward fulfilling their plan to run the MMSW off the map. Thus, they were desperate to make a spectacular gain. By forcing the Garfield dispute to Washington—where the Commie-line unions are currently out of favor—they could depend on making at least some gains. Seldom has a Government arbitration panel failed to appease Big Labor.

In this struggle, each union brings into action the best weapons it can find to score a gain over management which can be used to advantage in the fight over bargaining control.

The USA-CIO tactics have proved successful in steel: make one big company a target for your demands and, when it resists, get the Government to back you up. Then, you use what you have won as a pattern for other companies to follow. The steel union's bargaining objective is to impose on metal mining the wages and welfare benefits won after years of struggle in steel.

MMSW has other tactics. Lacking influence in Washington, it prefers to make its gains through the traditional strike threat and, where necessary, striking. It would like to bargain — and strike — industry-wide. MMSW leaders will struggle desperately to retain the opportunity to jam such a strategic industry in case of war with Russia.

It is important to understand that the employer and what he has to offer are relatively inconsequential in this grandstand play for position. It is not part of the strategy of either union to keep their demands modest. Both seek to make a spectacular gain at the employer's expense or in the case of CIO, show that it can force a concession by provoking Government intervention.

Wide World Photo

LARSON SAYS NO, as MMSW v.p., to WSB's request to end copper strike while Board acts. This reply Aug. 29, put next move up to Truman

With the Government such a big factor in the situation, employers are limited in what they can do.

Under the Taft-Hartley Law, they may not interfere with a bargaining control fight by aiding any union. The National Labor Relations Board will certify the workers' "free" choice as bargaining agent at each facility.

On wages, the unions take their cue from the Wage Stabilization Board. It has no firm limit on wage increases, and unions have learned they can get approval of almost anything, if the employer will agree.

Taft-Hartley Avoided

Where agreement is lacking, unions can get a dispute referred by the White House to WSB for "recommendations" if they create a serious situation affecting defense production. That's what CIO President Philip Murray's Steel union did in the dispute with American Smelting & Refining Co. at the Garfield smelter. This step avoids use of the Taft-Hartley 80-day national emergency injunction if WSB is instrumental in bringing about a settlement.

Despite these outside factors, the shrewd mining manager will not throw in the towel. Instead, he will try to bargain for his company—separately—and try to get the best bargain he can on the basis of available economic facts affecting the company's business. Even within general patterns there is room for bargaining on special factors or problems. The wise employer will appeal to the good sense of his own employees. Charges of Communist or labor dictatorship won't help much.

Murray's union took a big gamble in the feud with Mine-Mill when it pulled 1,350 employees at the AS&R smelter out on strike on July 2. It wanted to take credit for setting a 1951 wage pattern for the industry in the first steel union contract with AS&R. USA-CIO Local 4347, one of the first to leave Mine-Mill and adhere to CIO policies, is perhaps the strongest steel local in the nonferrous mining industry.

Mine-Mill watched, let its negotiations with the Big Four—Anaconda, AS&R, Kennecott and Phelps-Dodge—and others drag. When the strike ran into the second week, Mine-Mill felt it had to get tough, too. In mid-July it accused employers of "stalling" on the union's demands for higher wages and better pensions, insurance, sick leave and vacations. Strikes were threatened and a generally belligerent attitude assumed.

President Truman stepped into the AS&R strike after Mobilizer Charles E. Wilson reported how seriously the loss of 24,000 tons of copper and the daily loss of 250 tons of sulphuric acid was hurting the defense program. He sent the case to WSB as its first labor dispute. This made headlines for the steel union, whose members returned to work at WSB request.

Mine-Mill made some headlines on its own. It held a nationwide strike vote among its members the first of August, got overwhelming support. This was not surprising. Union members normally back up their bargainers with a strike vote. By plan, Mine-Mill had extended its contracts so that they expired or permitted a strike on August 1. This was the first time it had been able to accomplish this. The reason: It permits a single strike against all employers at the same time.

Mine-Mill got 11 AFL metal trades unions who had contracts with the same companies to cooperate in the drive for higher wages. They formed the Intermountain Trades Council.

Actual strikes were few. But deadlocked disputes were numerous. The Federal Mediation and Conciliation Service worked furiously to avert a nationwide strike which would cut off 90% of domestic copper production. It used every device it could. Expert conciliators went out from Washington. In some disputes, panels of con-

The Backdrop—Industry-Wide Bargaining

MINING MEN, whether employers or workmen, are faced with a tough choice in the labor-union field these days—a problem in which the Garfield deadlock and the damaging general strike in copper are merely incidents. The choice they make is likely to have a far-reaching impact, both on themselves and the industry.

For the moment the choice is mainly between CIO's powerful steelworkers and the Commie-line MMSW. In this struggle, local wages and working conditions are of small consequence. But behind, if either scores a clean win, there looms up the portentous issue of industry-wide bargaining, which both would like to establish.

To the workman, the real issue is not what each of these desperate antagonists will get for him right now in the way of wages and working conditions. It is whether he will continue to bargain with his employer on an essentially local basis in the light of local conditions, or will gradually become a pawn in the operations of big-time labor politicians, in whose struggle for power he and his particular problems will be of little consequence.

On the marginal operation, actual or potential, industry-wide bargaining will impose a new, immovable road block. The union will go after the "blue chips" and when it has settled with them, the marginal enterprise can conform or die, as best it can.

To the blue-chip operations, industry-wide bargaining means that they will be the focal point of union attack every bargaining season. They will join the unhappy company of Big Steel, Big Coal, and Big Automotive Industry, chessmen in the top-level struggle for power in Big Labor. By virtue of their importance in the national economy, they will be forced into an ever-tightening net of Government control.

In our opinion, both employers or the working rank and file stand only to lose in the long run from being drawn into the web of big union politics via industry-wide bargaining. Both will profit most from the avoidance and settlement of disputes at the local level, where the individual problems of both workman and employer will receive maximum consideration. This may be a side issue during the heat of any particular dispute, but in the final analysis, the only way that either management or men can continue to protect their individual rights and bargaining power is to insist on local settlement of their problems.

The wise employer recognizes that a vote for Communist-line leadership is not a vote for the Politburo. It is a vote for militant leadership, born out of lack of confidence in the employer. He will make it his first order of business to earn the loyalty and trust of his employees, most of whom have, despite appearances, an innate loyalty and a desire to take pride in their jobs.

ciliators were utilized. Not only Western mining, but processing in the East was threatened.

On August 13, FMCS announced that conciliators had been assigned to disputes involving: Anaconda at Butte; Phelps-Dodge in Arizona; Inspiration Copper in Arizona; Kennecott at Salt Lake City; AS&R at Perth Amboy, N.J.; Coeur D'Alene Idaho; mine operations around Silver City, N.M., and the American Brass Co., operating fabricating plants in New England and Buffalo.

In Idaho, the Sunshine and Bunker Hill mining companies refused to bargain on a district basis with Mine-Mill. The local at Mullan withdrew from Mine-Mill's nationwide strike program, although professing support for district-wide bargaining. Resentment against the international union was expressed through the demand of three locals at Mullan, Wallace and Kellogg that R. W. Hanson be removed as international representative in that area. He was accused of "causing disunity" among the three locals.

The major union demand is higher wages, wages higher than Government stabilization rules permitted—at least at the time they were made.

Mine-Mill was after 20¢ an hour more, plus better pensions, insurance, sick leave and vacations.

USA-CIO asked these of AS&R: General increase of 25¢ an hour, job reclassifications, a non-contributory pension plan of $125 a month, non-contributory social insurance, time and a half for work on holidays, Memorial Day as a seventh paid holiday, and the union shop.

WSB had a three-man panel hear the issues. It was headed by Lloyd K. Garrison, and included G. Allan Dash, Jr., Philadelphia arbitrator, and Vernon H. Jensen, Cornell University professor and writer on metal mining labor relations. Garrison, as a member of the War Labor Board, helped start the costly job reclassification plan in steel. He also headed the General Motors strike panel in 1945-46 which recommended a 19½¢ wage increase and thus helped set the first-round wage pattern of 18½¢.

On the job reclassification, AS&R told the panel it was agreeable to raising the base rate from $11.05 to $11.30 per shift if it applied to surface (non-operating) common labor. It opposed the proposed increase in job differentials in 16 classifications to 5¢ an hour as too costly, but would agree if the average did not exceed 8¢ an hour, in addition to the 3½¢ increase in the base rate. This would make a total of 11½¢.

This, the company said, would make a total increase of 21½¢, including the 10¢ granted last October, or 15% above January, 1950, base date for wage stabilization.

AS&R also justified its stand by pointing out that when the U.S. Steel job reclassification went into effect in 1947 it cost only 7.32¢ an hour; that in iron ore mining, the cost is set at 8½¢, and that wage increases in nonferrous metals at least kept pace with those in other industries.

The company warned of the possible serious economic effects if the Western nonferrous industry is loaded with distorted labor costs.

M. A. Hanna Will Expand Menominee Range Output

A program of expansion, to cost several million dollars, has been started by Hanna Iron Ore Co. at its Bengal-Tully-Baker iron ore property at Stambaugh, Mich., in the Iron River district on the Menominee Range, according to H. L. Pierce, vice president of The M. A. Hanna Co., parent company of Hanna Iron Ore Co. Erection of a surface plant is included in the program as well as the sinking of a new shaft, an undertaking that will require two years to complete. The shaft will be named after George M. Cannon, former general manager of the company's Iron River district mines, who is now retired. Production will greatly exceed the 200,000 tonnage annually turned out by the present Bengal mine which is included in the property.

(Continued on Page 104)

Exide-Ironclad

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ARE YOUR BEST POWER BUY— AT ANY PRICE

They PROVIDE ample power for fast, high-production haulage—more trips per shift, dependable round-the-clock performance, with no end-of-shift slowdown, no unscheduled down time . . . ASSURE inherent safety, with freedom from hazards of fire, fumes, noise . . . SHOW low costs of operation, maintenance, repair, depreciation. SIZES for all makes of battery-powered mine locomotives, trammers, shuttle cars. Call in an Exide Representative and let him prove these facts.

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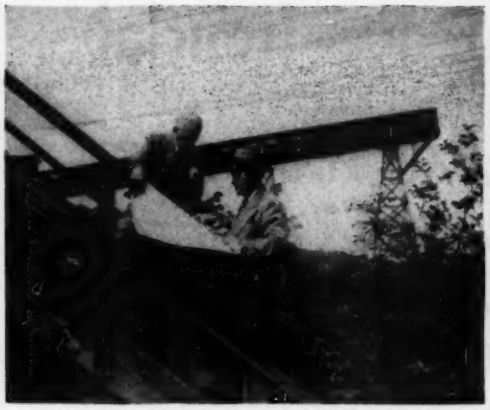


COL. LEWIS SANDERS, president of Ringwood company (left) checks plans with GSA agent John D. Halloran.

JOHN HALLORAN (left) and Emanuel Walker, skilled miner, examine ore exposure in haulage level of the mine.

IDLE SKIP TRACK at the headframe of the old Peter mine will be restored to haul ore from reopened workings.

AFTER RECENT disclosure of Ringwood's plans to resume mining, New York newsmen prepare for a trip in the skip.

Iron Mining to Resume at Ringwood, N. J.

Iron mining will be resumed in the Ramapo Mountains of New Jersey, according to plans of Ringwood Iron Mines, Inc., which recently bought the old Peter and Cannon iron mines from General Services Administration for $1.5 million. The purchase includes 877 acres of ground, a concentrating plant and railroad spur. Mine operations are only an hour's ride from New York City.

Col. Lewis Sanders, president of the Ringwood company, reports that chief ore minerals are magnetite and martite in the ratio of 2-2½ to 1. Ore averages 52.35% iron, 1.2% phosphorus, and is low in silica. Country rock is a strong pegmatite which permits open stoping methods. Ore occurs as a series of elliptical lenses with horizontal cross-sectional areas varying between 800 and 14,000 sq. ft. Dip of the orebodies is about 85 deg. Both the Cannon and the Peter mines contain six orebodies, and two more undeveloped bodies are in evidence in each mine. Faulting is post-mineral, varying from a few inches to a few feet, and will not hamper mining.

The mining method will be changed from the former sub-level system with levels at 100-ft. intervals, to open stoping with underground gloryhole and 200-ft. level intervals. Slushers will transfer ore from the gloryhole to mine cars. Roof bolting will be used where ground support appears necessary.

The concentrator, built during World War II to produce lump ore and a coarse concentrate for emergency use, will be revised. The present flowsheet produces a 5-mesh product running 0.5% phosphorus, while the new simplified flowsheet will turn out a minus 65-mesh product running about 0.1% phosphorus. Additional ball-mill capacity will permit finer grinding. Pelletizing furnaces will be installed to produce a desirable blast furnace or open hearth product. Research is also under way to produce a high grade iron powder and possibly elemental phosphorus or phosphoric acid.

David A. Goodkind, of New York, who had the courage and vision to stick with Climax Molybdenum during its early struggle for success, has made this new enterprise possible.

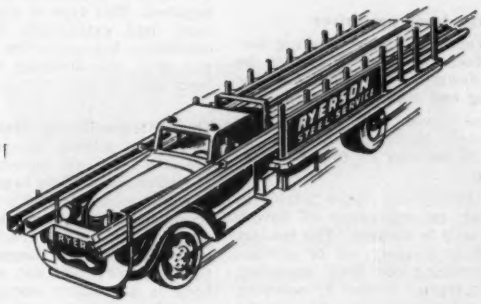
("This Month in Mining"

continued on page 122)

RYERSON

Ryerson Steel Service awaits your call at thirteen great plants, strategically placed across the nation.

STEEL



Every kind of steel is on hand for quick delivery. Though stocks are currently unbalanced, most requirements are usually available.

SERVICE

Ryerson representatives are ready to assist you on any problem involving the purchase, fabrication or application of steel.

PRINCIPAL PRODUCTS

CARBON STEEL BARS—Hot rolled and cold finished
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PLATES—Many types including Inland 4-Way Safety Plate
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TUBING—Seamless and welded, mechanical and boiler tubes
ALLOYS—Hot rolled, cold finished, heat treated. Also tool steel
STAINLESS—Allegheny bars, plates, sheets, tubes, etc.
BABBITT—Five types, also Ryertex plastic bearings
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JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • CINCINNATI • CLEVELAND
DETROIT • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO

KEEPING TAB ON PRACTICE

On Choosing the Trailer Truck. To explain why the side-dump trailer truck was adopted for his work, one open-pit operator gave the following reasons:

1. Large loads per driver.

2. Exceptionally large braking surface. Much of the ore had to be hauled down an 8% grade to the screening and crushing plant.

3. Time saved each trip. Truck makes one stop, dumps, then returns to pit. No backing up to the hopper to dump.

4. By having one spare tractor in each fleet, the equivalent of having a spare unit is secured. The trailers are seldom, if ever, out of service. When servicing the fleet, moreover, the spare tractor is used by servicing it first and exchanging with tractors in the pit.

5. Having 4-wheel drive units with all tires the same size, there is no trouble with traction in wet or slippery weather.

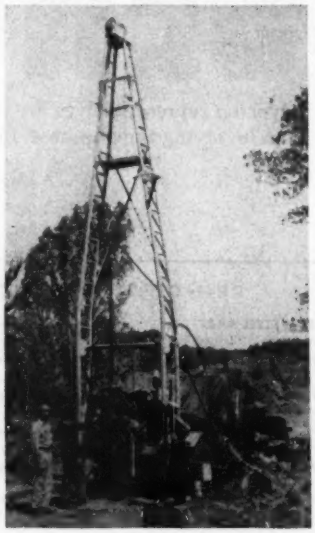
6. The combination of 4-wheel drive plus the rolling load on the trailer, all wheels being at a slightly different gage, actually produces a road-rolling action when hauling 35-ton loads. In consequence, road maintenance expense is low.

7. No difficulty in getting drivers for trailer units. Men like them because of the easy riding conditions.

Another operator holds that the tractor-trailer type of truck with bottom or side dump has proved itself economical and a good producer. This unit was originally placed in operation by contractors, where the haul was relatively flat and the material fairly free of large boulders which usually give this type of equipment trouble, because the size of the opening of the doors is not over 30 in. The success led other mine operators in the district to try some of these units and they proved successful.

There is a disadvantage where this haulage unit operates over heavy grades, however, according to this operator. It has been his experience that on grades of 8% or more these units lose traction, due to the fact that on an inclined plane the center of gravity shifts more and more towards the rear wheels, and increases the tendency for the tractor or haulage-unit wheels to spin. Some difficulty has been experienced with this in wet weather during summer operation, and also in the winter time when roads become slippery due to frost and at times when snow is falling and cannot be dozed off as rapidly as required. This type of equipment has been used extensively in stripping operations, but only a few units equipped with side-dumping bodies have been used in ore.

The Bottom-Dump Truck-Trailer. One large mining company reports use of a 25-cu. yd. bottom-dump type of trailer-truck. They have found that it works well if no large boulders or frost chunks are encountered. The dump opening on this truck is restricted so that, if large pieces cannot get through, they will not unload. The body is not sturdy enough for rock stripping, nor does the unit have power enough to negotiate steep grades (8%) at a reasonable speed. This operator thinks that with the right kind of material and a long, fairly level haul the bottom-dump model will do better than the conventional rear-dump truck.



NEW DIAMOND DRILL used by Minerals Engineering Co. in exploration work in Arizona.

Impact on End-Dump Type? foregoing is of particular interest in connection with Mesabi truck-transport practice, where the end-dump type carrying its load on its back dominates among the 1,000 or so heavy-duty trucks in service. The same operator expresses himself further saying he thinks that end-dump trucks are much safer to handle on the dump than the side-dump type. Also from the viewpoint of one who is bulldozing material over the edge of the dump, he thinks they are much cheaper than either the side or bottom-dump type. (The controlling factor is that larger pieces can be handled in the end-dumps, at least on the Mesabi, compared to those handled in the other two models.) The only side-dump trucks working on the range are of the tractor-trailer (or trailer-truck) design and do not as yet have a high-horsepower engine. As the same operator sees it, the 30-34-ton straight trucks now the vogue on the range (powered for the most part with twin engines and torque converters. See also *E&MJ* July 1951, pp.102-104.) and the 45-50-ton models under test will handle larger tonnages and yardages per hour, offsetting the larger capacity of the present truck-trailer.

Shakers in German Iron Mine. Shaker conveyors are being used over distances of about 35 ft. in one iron mine in the Hartz district, according to A. E. Lance, *Mining Magazine*, July 1951. Fed by two men, a 15-in. trough operated by a 10-hp. motor moves 18.76 tph to the chute. The breaking properties of the ore have been studied so that the drilling and blasting will yield sizes that can be handled readily by the shaker.

New Core Drills Have Special Features. Ray Sullivan, of Minerals Engineering Co., Grand Junction, Colo., claims that the diamond drills the company has been using on exploration work in the Lukachukai Mountains, Arizona, have been outperforming other units of the same type in the field. They have certain special features. The machine is the new CP-8 pneumatic hydraulic drill with a CP-15 head. Power is supplied by a Ford industrial motor. The pumps, which are on the left side of the rig, are Bean No. 20 water pumps, driven by Wisconsin 2-cylinder, 11-hp. engines. The water tank, on the front of the drill, has 685-gal. capacity, with storage space in one corner for 12 gal. of hydraulic oil, this feature serving to keep the oil cool. The drill is truck-mounted and completely portable. It has ample space for rods, casing and for storing tools. The mast is 26 ft. high off the ground. Screw jacks on the rear corners serve to stabilize the truck. The photo shown is representative of the last batch of nine assembled in Minerals Engineering's shops.

New solution to an old problem!

here's an economical way to produce mine backfill from mill tailings...

The DorrClone* (Dutch State Mines Cyclone) is a compact classification unit employing centrifugal force in place of gravity. It provides a new solution to the old problem of support in underground openings . . . efficiently and economically. Keynote to DorrClone operation is the shearing force developed by centrifugal action. This force destroys flocculation in the feed pulp . . . results in efficient classification in the 20 micron to 150 mesh range.

DorrClones . . . can operate either as open circuit classification units or in a two-stage system depending on local conditions. In either case a clean, deslimed sand is produced. Automatic density controls insure a continuous flow of sand having the necessary percolation rate.

DorrClones . . . are extremely flexible. For example, one installation now in operation deslimes at the mill with one DorrClone—repulps the clean sand discharge to 45-50% solids and pumps it to the mine—then a second DorrClone located at the point where fill is to be placed thickens it to 68-70% solids.

Better Tools TODAY... to meet tomorrow's demands

Regardless of your particular mining operation, tailings composition or fill requirements, the DorrClone is an ideal tool with which to solve backfill problems. Inquiries should be addressed to The Dorr Company, Engineers, Barry Place, Stamford, Conn. or, in Canada, to The Dorr Company, Engineers, 80 Richmond Street West, Toronto 1.

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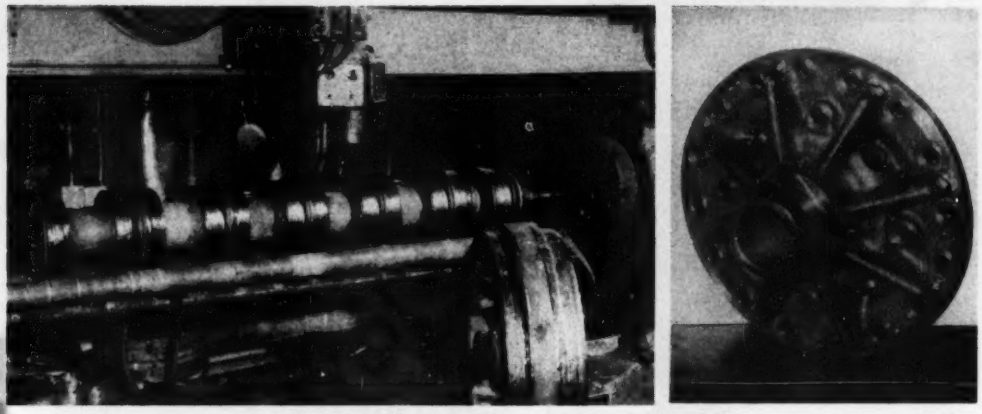


SERVICE LIFE of tractor idler rollers (left) was doubled by hard-facing surface before putting them in use. Track roller surfaces are also rebuilt with hard surfacing. Cracks in flange case of truck differentials (right) have also been repaired by welding with high-carbon rods.

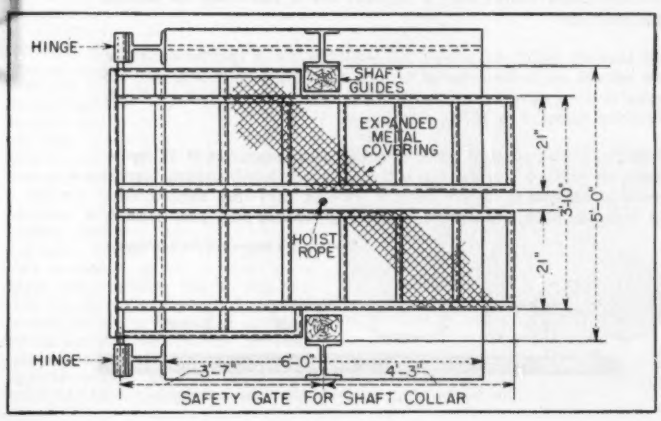
Cost-Cutting Maintenance Tips from the Iron Country

These two useful maintenance ideas were released by R. W. Whitney, general manager of Minnesota Mines, of The M. A. Hanna Co., Hibbing, Minn.:

1. Hard-surfacing on idlers and track rollers. Average life of idlers on D8 Caterpillar tractors ranged from 2,000 to 5,000 hr., depending on the service and type of footing in and around iron mines. Service life was doubled by putting a thin coat of hard surfacing on the idlers before placing them in use. Hard surfacing utilizes a high-carbon alloy rod put on with an automatic submerged arc known as "Unionmelt." Track roller surfaces are rebuilt with hard-surfacing after the initial wear period, and are giving good service with no evidence of weld checking or damage to tractor rails.

2. Welding differential flange cases. Considerable difficulty had been experienced with reinforcing spokes of the flange case for differentials on 1FFD 30-ton Euclid trucks. The spokes broke off the mounting ring after approximately 3,000 hr. of service. Welding the cracks in the spokes with a high-carbon rod was tried and appears to be successful. To date only one out of 12 flanges welded has failed. It was welded again and put back into service. Welding of reinforcing spokes on flange cases was started because parts were scarce.

Hinged Safety Gate for Shaft Workers



G. M. Priske, master mechanic, Sigma Mines (Quebec), Ltd., submits this drawing of a gate which permits safe performance of repair work at the shaft collar. Formerly workers covered over the collar of the shaft with planks —a practice which was neither safe nor easy. With the safety gate shown here, workmen simply release a locking device, and lower the gate over the shaft. A hand-winch aids in raising the gate. The gate is hinged to steel posts at the rear of the shaft. The framework of 4-in. channel iron is covered with 1½-9-6 expanded metal. A slot is used to clear the hoisting rope as the gate is lowered.

The shaft collar is completely enclosed with either light-weight plate or screening on three sides.

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No haul too tough . . . no ore too rough for Quaker Conveyor Belts. That's why they are used in the leading mines throughout the nation. Belts that assure minimum of maintenance and low cost conveyor operation.

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For maximum tonnage hauled, equip your conveyors with Quaker belts. There's longer life built into each one . . . more service in every foot. Call your nearest Quaker Distributor for performance-proved Quaker Industrial Rubber Products.

FOR POSITIVE POWER
Quaker Transmission Belting is pre-tested for maximum horsepower transmission. Available for all types of drives—from fractional horsepower to the largest installations.

HOSE FOR RUGGED WEAR
There's a Quaker Hose for every use in the coal industry—from the air hose on the lowest level to the water hose in the washer.

FOR SAFETY . . . ALL WAYS
Quaker's Mine Trolley Cable Guard offers protection for mine cables. It is specially compounded of synthetic rubber to resist mine damp, acid and water. It is also resistant to fire which adds an extra safety margin and prevents breakdown.

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Geology Courses Aid Shifters at Consolidated Beattie

The idea of giving shiftbosses a basic training in geology was conceived by the mine superintendent at Consolidated Beattie Mines, Duparquet, Quebec, to aid in raising grade of ore and help the bosses understand their jobs better. Campbell Fox and W. Hubacheck, of the mine staff, give the following account of the successful training method employed.

Shiftbosses receive basic instruction in geology by spending one month with company geologists. During this training period, each of the company's two geologists alternated in taking a shiftboss underground.

At the start of each course the shifter was given a mimeographed outline including: a list of local rock types; a list of local minerals; underground mapping information—how to make basic surveys, pertinent geological features to be observed, legend used at the Beattie mine (colors, symbols, etc.); definitions of geologic terms and explanations of structural terms.

Office instruction was tentatively arranged in the following order, and time spent on each topic was adjusted to meet the student's ability to grasp the subject: How to make the following maps—(1) plans, (2) cross-sections, (3) longitudinal sections.

How to plot the following data on the maps mentioned: (1) geology, (2) diamond drill holes, (3) assays.

The following examples illustrate the type of information given to the shifters to aid them in distinguishing ore from waste, and becoming acquainted with practical geologic information:

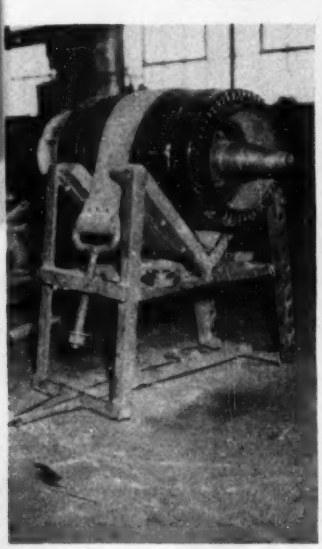
Example 1. "In the mineralized grey prophyry zone, the major fracturing, shearing, or schistocity adjacent to the contact between the porphyry and the lava parallels the contact as a rule."

Example 2. "The transverse faulting in this area trends N 30 E or N 30 W. It has turned out to be an arbitrary rule that if a drift is being driven east and intersects a north-east fault, the drift should be turned to the north to pick up the faulted segment. Thus if the fault is north-west, the east side throw would be south, and a drift driven from the east would turn to the north at the fault to pick up ore."

LORNE WILLETT, mine captain, learns about geologic office procedure which will help him do a better job of following ore and keeping grade as high as possible.

After shifters had a better understanding of points like these, they were able to keep drifts, sub-drifts, and raises driven on or near the contact more nearly in the ore, particularly where the orebody was irregular or faulted.

Supervisors at Beattie are convinced that training of shifters has justified the time and effort spent.



Armature Rack For Motor Repairs

The special racks shown here hold armatures while bearings and housings are being installed or removed. They were built under the direction of George N. Truby, master mechanic, Allegheny Pittsburgh Coal Co., Logan's Ferry, Pa. Major parts of the rack are a steel and wood saddle to bear the weight of the armature, and a piece of leather belting to strap the armature in the saddle. One end of the bar is looped to receive a bar which is placed through matching holes in vertical members on one side of the frame. (See illustration.) The other end of the belt is attached to a bolt which may be drawn up for final take-up as shown at left. Idea, courtesy *Coal Age*.

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- Z-4—Sodium Ethyl Xanthate
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- Z-6—Potassium Pentasol Amyl Xanthate*
- Z-8—Potassium Secondary Butyl Xanthate
- Z-9—Potassium Isopropyl Xanthate
- Z-11—Sodium Isopropyl Xanthate

*From Sharples Amyl Alcohols.

Bear Brand Xanthates offer the best answer to practically every problem found in the separation of sulphide minerals and in the flotation of precious metal ores. They are important because they combine good collector power with extreme selectivity. They are easily applied and act rapidly. Bear Brand Xanthates are among the most widely used flotation reagents in the world.

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PERSONAL NEWS

Russell G. Haworth has become resident manager at Potash Company of America, Carlsbad, N.M., succeeding **Parker S. Dunn**, who resigned to take a position with American Potash & Chemical Corp., Trona, Calif.

Keith Whiting has been promoted to chief exploration engineer for the American Smelting & Refining Co. in their Northwest division, headquarters at Salt Lake City, Utah. Whiting was formerly chief geologist for the Northwest division at Wallace, Idaho.

Robert W. Van Evera, formerly pit foreman at M. A. Hanna's Galbraith mine at Nashwauk, Minn., is now chief engineer for Reynolds Jamaica Mines, Ltd. of Reynolds Metals Co.

W. B. Austin of Jefferson, N. C., was named chairman of the Mineral Resources Committee of the North Carolina State Board of Conservation and Development and **J. C. Murdock**, vice president. Other members of the committee are **Fred P. Latham** of Belhaven, **Hugh Morton** of Wilmington, and **Dr. W. Locke Robinson** of Mars Hill.

Charles E. Tonry has resigned from Southwestern Engineering Co. to accept a staff position with the U. S. Bureau of Mines at the oil shale demonstration plant at Rifle, Colorado.

S. Power Warren announces that he expects to terminate his employment by Defense Minerals Administration shortly. He will return to consulting work, foreign or domestic. He may be reached at 1400 Country Club Road, Lakewood, Colo.

S. G. Lasky, who graduated on June 22 from the Industrial College of the Armed Forces, has been appointed special consultant to the President's Materials Policy Commission, on loan from the Department of the Interior. Prior to being detailed to the Industrial College, he was chief of the Mineral Resources Section of the U. S. Geological Survey. He can be addressed either: President's Materials Policy Commission, Executive Office Building, Washington 25, D. C., or Minerals and Fuels Div., Department of the Interior, Washington 25, D. C.

The Hon. Lewis W. Douglas, former American Ambassador to Great Britain, and **I. C. Raymond Atkin**, vice president, director and member of the executive committee of J. P. Morgan & Co., Inc., have been elected to the board of International Nickel Company of Canada, Ltd.

Henry L. Day, president of Day Mines, Inc., at Wallace, was elected president of the Idaho Mining Association. **J. E. Berg**, general manager of the Federal Mining & Smelting Co. at Wallace received the vice presidency. **Harry W. Marsh** was re-elected secretary-treasurer. On the executive committee are **E. B. Douglas**, Cobalt; **J. G. Miller**, Pocatello; **E. E. Coleman**, Stibnite; and Robert M. Hardy, Jr., Kellogg. The election took place at the Association's annual meeting at Sun Valley.

J. E. Archer has been appointed assistant director of American Cyanamid's patent department. Mr. Archer's offices will be at the company's laboratories in Stamford, Conn.

HOWARD L. WALDRON, formerly field editor for *Mining World* has joined the staff of *E&MJ* as associate editor. A native of Montana, Mr. Waldron attended Montana School of Mines for two years, leaving to serve in the U. S. Army Signal Corps. He completed his junior year at Georgia School of Technology and served as a sergeant in repeater-carrier communications in the Pacific Theater. After the war, he worked as a civil engineer and then returned to Montana School of Mines, graduating with honors as a Bachelor of Science in Mining Engineering. Fields of employment have been underground mining in Butte, field surveying, estimating and shipbuilding. He joined the staff of *Mining World* early in 1950. His article, "Round Mountain Gold," was chosen by *Industrial Marketing* as the best single article in any trade, merchandising, or export publication in the year 1950.

A. E. Cameron is now mill superintendent for M. A. Hanna's Ozark Mining Co., Iron Mountain, Mo.

G. T. Harley, International Minerals & Chemical Corp., Carlsbad, N.M., has been appointed by **Governor Edwin Mechem** as a member of the newly created Board of Educational Finance of New Mexico. The board will set up budgets for state schools. Harley was formerly a member of the faculty of the New Mexico School of Mines, now the New Mexico College of Mining and Technology, at Socorro.

Philip R. Bradley, Jr., chief of the Ferro Alloys Branch of Defense Minerals Administration's Supply Division for the past six months, is returning to California to resume his duties as a private-industry consulting engineer. He is succeeded by **George B. Holderer**, assistant chief of the branch since February.

Pat Boileau, mining engineer, has joined M. A. Hanna's engineering staff at Iron River, Mich., as engineer at the Bengal-Tully mine.

Ernest Soderberg has been appointed engineer at The M. A. Hanna Co.'s Wauseca mine at Iron River.

Leonard J. Harris, mining engineer with Pickands Mather Co. in the Iron River district, has resigned to become city manager at Stambaugh.

Harold J. Christy, Wakefield, Mich., has been transferred from Jones & Laughlin's Vicar mine, now closed down, to the company's Tracy mine at Negaunee, Mich., where he will be assistant superintendent.

Otto Herres has left DMA to return to his position as vice president of Combined Metals Reduction Co., Salt Lake City, Utah.

Harry Haller, Wakefield, Mich., and former engineer at the Sunday Lake mine of Pickands, Mather & Co., is now located at Barberton, Ohio, where he is assistant to the president of the Columbia Chemical Corporation.

R. N. Haskell, Hubbell, Mich., superintendent of Calumet & Hecla's mills and reclamation plants, retired June 1.

Robert E. Prittinen has joined the engineering staff of the Jones & Laughlin Ore Co. at Negaunee, Mich.

Dale G. Wilson, formerly with the Libbey-Owens-Ford Glass Co., is now head of the industrial engineering department of Calumet & Hecla Consolidated Copper Co., Calumet, Mich.

Thomas Carlson, son of Oscar Carlson of Inter-State Iron Co.'s Hill-Annex mine at Calumet, Mich., has won the Kennecott Copper Co.'s scholarship for third-year mining at the Michigan College of Mining & Technology.

Six M. A. Hanna Co. employees on the Mesabi Range have been promoted to foremen: **George Koemptgen**, for the conveyor-dragline operations at the Waldron mine; **Herman Wirtz** and **Nathan Martin** for the washing plant in the Cooley district; **John Gernert**, at the Weggum pit; **Angelo Corradi** for the Morton mine shop; and **Arvie Lake** at the washing plant at the Perry mine.

R. E. Renshaw, formerly on the engineering staffs of Pioneer Gold Mines, Ltd. and Golden Manitou Mines, Ltd. has been appointed resident manager of Hamil Silver-Lead Mines, Ltd. at Argenta, British Columbia.

A. J. Theis, of Seattle, Wash., has been elected a director of Kootenay Belle Gold Mines, Ltd., operating at Sandon, British Columbia. Mr. Theis has been an exploration engineer and consultant for Anaconda Copper Mining Co. since 1945. He has managed several mining operations in California and elsewhere.

George W. Robinson, formerly manager at Taku River Gold Mines, Ltd. has been appointed resident general manager of Estella Mines, Ltd., near Wasa, in the Cranbrook area of British Columbia.

R. Erin McAllister has been appointed western manager of the Chemical and Fertilizer Sales Department of Consolidated Mining & Smelting Co. of Canada, with offices at Vancouver, B. C. He replaces A. G. Park, who has joined the fertilizer sales staff of Balfour Guthrie & Co., Ltd., San Francisco.

Henry P. Slater was appointed chief electrician at the Reduction Plant of Kennecott Copper Corp. at McGill, Nev., effective April 1.

Donald C. Kimball, formerly with Combined Metals Reduction Co., Stockton, Utah, is now with the engineering department of Oglebay Norton & Co., at the general iron mining offices of the company at Duluth, Minn.

Gordon S. de Villiers, underground manager for Anglo-Transvaal Consolidated Investment Co., Ltd., Johannesburg, South Africa, is presently in the United States acting as consultant to the E. J. Longyear Co., Minneapolis, Minn. Mr. de Villiers was in charge of the Virginia No. 3 shaft in the Orange Free State, which in two successive months this year broke the world's record for shaft sinking, culminating with the accomplishment of 504 ft. of sinking and concreting during the month of April, 1951.

S. C. Sandusky has retired from service with the St. Louis S. & R. Div. of the National Lead Co. after more than 25 years' employment as engineer, chief engineer, mine superintendent, general superintendent, and resident agent at their Baxter Springs, Kans., operations.

Dr. T. S. Lovering, staff research geologist for the U. S. Geological Survey, may now be reached at 8001 West 17th Ave., Lakewood, Colo.

Dan Johnson, formerly consultant for The Fresnillo Co. at Zacatecas, Mexico, is now general superintendent at the Naica unit.

E. R. Drevdahl has been appointed assistant professor of mining engineering at the South Dakota School of Mines & Technology, Rapid City.

H. J. Schroeder, mining engineer, is now with DMA Field Team, Region V, Minneapolis. Mailing address: U. S. Bureau of Mines, Platteville, Wisconsin.

J. F. Cowley has resigned as mining consultant for Eti Bank Ankara, Turkey, to become president of Vermont Copper Co., Inc., South Strafford, Vermont.

Robert Waskey is now with the Industrial Minerals Branch, Defense Minerals Administration, Washington, D. C., as mining engineer-analyst.

A. H. Lindley, Jr., is presently commodity specialist with the Bureau of Mines, Foreign Minerals Region, Washington, D. C.

Charles H. Dunning has resigned as director of the Arizona Department of Mineral Resources and will engage in the private practice of mining engineering. Mr. Dunning can be reached at 1635 W. Earll Drive, Phoenix, Ariz.

Lucien Eaton, Jr., is now employed as engineer by the Hibbing Office, North Central Div. of the Western-Knapp Engineering Co. Mr. Eaton was formerly senior draftsman of the Aluminum Company of America at its Badin, N. C., Reduction Plant.

H. C. Milton has been named assistant district sales manager of American Cyanamid's Industrial Chemicals Division at Boston, Mass.

COLONEL S. R. FLEISCHER, resident director of the New Consolidated Gold Fields' group in South America, has been elected president of the Transvaal Chamber of Mines for 1951-52.

New appointments at Howe Sound Co., Chelan Div., Holden, Wash.: T. L. Wilson has been promoted to the position of geologist. A. M. Sunde is now mechanical and electrical superintendent, replacing H. J. Clemmer, who resigned to take a new position. J. S. Mitchell is the new mill superintendent. Victor A. Zandon, former mill superintendent at Chelan, has been transferred to Britannia Mining & Smelting Co., Ltd., Britannia Beach, B. C. E. D. Haddon has been promoted to chief accountant and purchasing agent. W. E. Taylor, former chief accountant at Chelan, has been transferred to Calera Mining Co. cobalt refinery at Garfield, Utah, where he will be chief accountant and in charge of all purchasing and general business.

Paul M. Price, formerly research engineer at Howe Sound Co., Chelan Div., has been transferred to Calera Mining Co., where Robert Meen has been promoted to mine superintendent.

Alfred G. Lyle, metallurgist, has been transferred from Britannia Mining & Smelting Co., Ltd., to the Calera Mining Co. cobalt refinery in Garfield, Utah. He will assume his duties as research metallurgist the latter part of the year. In the meantime he will be at the Chemical Construction Co. research plant at Linden, N. J.

Paul T. Park has become mine foreman and J. S. Roper has become chief engineer for Howe Sound Exploration Co., Ltd., at Snow Lake, Manitoba.

Allan S. Richardson, chief ventilation and industrial hygiene engineer for the Anaconda Copper Mining Co., Butte, was awarded a distinguished achievement medal from his Alma Mater, the Colorado School of Mines.

Earl E. Hunner, retired general manager of M. A. Hanna Co.'s iron mines and now acting as a consultant, has made an inspection trip to the Quebec-Labrador iron ore property in which his company is interested.

R. H. Blackman has been named Industrial Relations Superintendent in charge of a new department at Potash Company of America, Carlsbad, N.M.

Stanley Hughes, previously serving as a consultant to the Kennecott Copper Corp., has been appointed assistant to the general manager, western mining divisions, smelting and refining operations. In this capacity he will report to Louis Buchman, general manager of the firm's western mining division, acting as liason officer between Kennecott and American Smelting & Refining Co., operator of the Garfield, Utah, smelter. Mr. Hughes supervised the design of Kennecott's own new Garfield electrolytic refinery during the years 1948 and 1949 when he was "on loan" to the copper concern. In addition, Mr. Hughes will advise on the operations of Kennecott's smelter at McGill, Nev., a unit of the Nevada Mines Div., and the Hurley, N.M., smelter, a unit of Kennecott's Chino Mines Div.

F. J. Hemsworth has been appointed to the newly-created position of resident provincial government mining engineer at Nelson, British Columbia, for East Kootenay, formerly a suboffice of the Kootenay engineer. He

was on the engineering staff of Sheep Creek Gold Mines in West Kootenay prior to appointment as provincial government resident engineer for Prince Rupert district in 1947.

The U. S. Smelting, Refining and Mining Co. announced the promotion of an executive June 25. **Byron E. Grant** was named assistant to **W. C. Page**, vice-president and general manager of Western operations. A graduate of the University of Utah, class of 1931, he completed major work in mining geology and also took graduate studies at the University of Idaho and the University of California. He joined the concern in 1936.

George Haney, principal of the Butte (Mont.) High School, has been appointed a member of the executive board of the Montana School of Mines by the State Board of Education, upon the recommendation of Montana's Governor **John W. Bonner**.

President L. B. Manning of the Mining Association of Montana has appointed a committee to cooperate with the Montana Civil Defense Commission. Members of the committee are **Stanley M. Lane**, metallurgist with American Smelting and Refining Co. at East Helena; **Alfred E. Nugent**, head of the N & N Mining Co., Helena; and **Ted E. Collins**, vice president of the Mining Association of Montana and head of the Collins Land Co. of Helena.

George Towsley has left the Phelps-Dodge plant at Bisbee, Ariz., where he was a sampling engineer, to accept a position with Cia Minera de Oruro. He may be reached at Casilla 154-155, Oruro, Bolivia.

Paul Zimmer, formerly geologist for St. Joseph Lead Co. in New York State, is now at Crosby, Minn., where he is Cuyuna range geologist for M. A. Hanna Co.

Arnold H. Miller, consulting engineer of New York, has been appointed by the Chilean Government to do work in connection with the plans of Chile's electrolytic copper refinery.

A. F. Kent has been placed in charge of mine operations at Estella Mines, Ltd. near Wasa, in the Cranbrook area of British Columbia.

B. Roy Smith, director of personnel of the Alcoa Mining Co. in Bauxite, Ark., is a district governor of Rotary International, world-wide service club organization, for 1951-52.

J. Bryden, J. H. Salter and B. P. Sutherland have been appointed administrative assistants of The Consolidated Mining and Smelting Co. of Canada, Ltd., at Trail, B. C. These men will assist the general manager in various capacities. **E. Benson** will succeed Mr. Salter as assistant manager of the Personnel Div. and **J. R. Mills** succeeds Dr. Sutherland of the Research Board.

Henry W. Persons and **John F. Thompson**, of Monsanto Chemical Co.'s Trenton, Mich., plant, have been transferred to the company's Phosphate Division engineering department, St. Louis, Missouri.

William F. Conroy, Anaconda, Mont., has been appointed superintendent of the Butte, Anaconda & Pacific Railway, a subsidiary of the Anaconda Copper Mining Co., by general manager **F. W. Bellinger**, the former superintendent.

DR. WILLIAM C. KNOPF has been appointed supervisor of the Mulberry, Fla., experiment station of International Minerals & Chemical Corp. Dr. Knopf was formerly assistant dean of the Northwestern University Technological Institute.

Nestorio N. Lim, secretary of the Philippine Chamber of Mines and formerly chief valuation engineer for the Bureau of Mines, is making a professional trip to examine manganese deposits in the Republic of Indonesia for local capitalists, as well as to inspect nickel and lead prospects in the same area.

After almost 18 years in South America, **Dr. N. de Voogd** has accepted a position with the Comité National du Kivú, Belgian Congo. Dr. de Voogd is in charge of all underground prospecting, sampling, evaluation, and—once evaluation is finished—the designing and construction of the mill. His address is: c/o C.N.Ki., Costermansville, Belgian Congo.

Weston Bourret has been appointed chief of the Minor and Rare Metals Branch of DMA's Supply Div. Mr. Bourret is now residing at 7208 Ramsgate Road, Woodacres, Md.

After a year spent in Milwaukee, Wis., **C. H. Plumb** has returned to Brown & Root, Inc., of Houston, Texas, developing their holdings in the Tri-State area, including a large strip-pit mine.

Nelson C. White has been appointed general manager and **Sinclair B. McCoy**, sales manager for agricultural potash of the Potash Div. of International Minerals & Chemical Corp., Chicago, Ill. **Milton S. Malone**, sales representative of the division, has been appointed district sales manager of the Potash Div. sales office at Atlanta, Ga.

Robert T. Mitcham is now an engineer for the Ground Hog unit of AS&R at Vanadium, N. M. Mr. Mitcham was formerly manager of the Edwin Larson mine, Elfrida, Ariz., and, for a short time, associated with the U. S. Bureau of Mines.

W. S. Kirkpatrick has received the appointment of vice president at Montreal of the Consolidated Mining and Smelting Co. of Canada, Ltd. Succeeding him as assistant general manager in Trail is **R. D. Perry. Kenneth Clare** has been appointed assistant secretary of the company.

OBITUARIES

Wilber Judson, of Newgulf, Tex., senior vice president and a director of Texas Gulf Sulphur Co., died at 71 on August 9. Born in Lansing, Mr. Judson received his S.B. degree from Harvard in 1901. He joined Texas Gulf Sulphur Co. in 1921 and was elected a vice president and a director five years later. He was also a vice president and director of Sulphur Export Corp. and a director of Mesabi Iron Corp. Mr. Judson had served as a member of the advisory committee on raw materials of the U. S. Atomic Energy Commission. He was a former vice president of the AIME and the Mining and Metallurgical Society of America and a member of the National Minerals Advisory Council. His clubs included the Houston, of Texas, and the Union League, Harvard and University, New York City.

Josie Bishop, "Radium Queen" of Cantil, Calif., died early in July as the result of an automobile accident near Mojave, Calif. She was 76 years old. For many years Mrs. Bishop has been a prominent figure at mining meetings in the West in energetic support of her belief that large deposits of radioactive ore existed in Southern California. Her name almost inevitably entered any conversation in regard to domestic sources of uranium, and she will long be remembered in Western mining.

William C. Northey, 89, a former superintendent of the Mahoning Ore Co., died on July 21 in Minneapolis.

Judge William Scallon, 95, famous mining executive and legal light, died at Helena, Mont., on July 5, after a short illness. A native of Joliet Province, Quebec, he received his law degree at McGill University and came to Butte in 1883. He was chief counsel for the Anaconda Copper Co., a forerunner of the Anaconda Copper Mining Co., and at the death of Marcus Daly, its founder, became president and Western manager of the early company. He held these positions at the time of the Heinze litigation. In 1904 he severed his mining

connections and returned to private law practice, moving to Helena in 1913, where he was associated for a time with the late U. S. Senator Thomas J. Walsh.

Herman L. Dauth, 60 years old, vice president and general manager of Compania Minera Santa Maria del Oro, S. A., Mexican subsidiary of International Mining Corp., died in New York on July 26. Mr. Dauth graduated from the Colorado School of Mines. He was a mining engineer of wide experience, having worked in the Western States, Alaska, Bolivia, Venezuela and Mexico. During World War II he was for a time with the Board of Economic Warfare in Washington. Mr. Dauth is survived by a daughter, Mrs. Gordon E. Thompson, and two sons, Robert and William.

Carl Arthur Lemke, long-time superintendent of the Midvale, Utah, smelter of the U. S. Smelting, Refining & Mining Co., died in Salt Lake City on July 31 at the age of 70. A graduate of the Colorado School of Mines, Lemke was a native of New York City and had once played professional baseball with the New York Yankees.

An author of many articles on mining and metallurgy, Lemke came to Midvale prior to World War I after serving as superintendent of smelter at Leadville, Colo. He first served as superintendent of the Midvale mill and, after a year, headed the smelter operation, holding the post of superintendent for some 21 years. Later he was superintendent of the Potash Company of America works at Carlsbad, N. M., retiring 10 years ago and returning to Salt Lake City.

Rodney Hillam, secretary-treasurer of the Salt Lake and Pioche Mining Co., died in Salt Lake City August 1. He was 81 years old and a native of Brigham City, Utah. During a long career as a businessman with several posts connected with mining projects, he at one time was associated with Martin Coal Co. as well as firms in the hard-rock field.

William G. Norrie-Loewenthal, 68, one of British Columbia's best known pioneer mining engineers, died at Vancouver recently. He was born in Georgetown, South Africa, and was educated at University College, London. Traveling to the U.S. in 1905, he worked as a miner and mill hand for a year before going to British Columbia. Following work at the Leroi mine, he was a consulting mining engineer for the past 20 years. Recently he was active in the new operations of Cronin-Babine Mines, Ltd., and Doreen Mines, Ltd.

Ivan L. Johnson, office manager for the Peru Mining Co., Hanover, N. M., was killed in an automobile accident near Silver City, July 28. Johnson was one of the 10 original members of the New Mexico state police and was district governor for the Lions Club.

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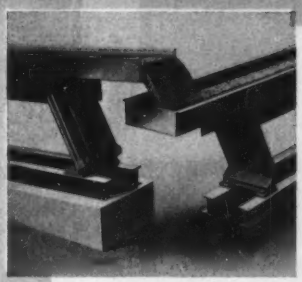

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CONVEYOR
(Patent Pending)

This MV conveyor operates at Positive Resonance, resulting in attractive power savings. Flexibility of design provides ruggedness required for any job and permits use of open or enclosed pan or tubular conveying decks. Floor or suspension mounting without loss of capacity. Write for MV Bulletin 826 for complete details.

GRIZZLY FEEDER

This type of feeder provides a vibrating feeder and non-clogging grizzly in a single unit. It is extremely flexible and handles large fluctuations in tonnage and feed size without mechanical adjustment. Installation shows unit feeding run-of-mine ore and by passing minus 3" material ahead of jaw crusher.

For details ask for Catalog 830

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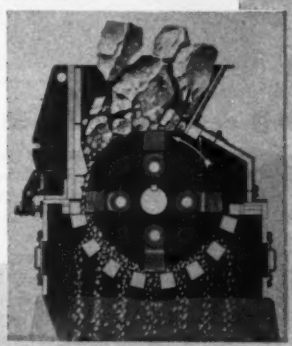
Illustrated is a standard belt conveyor with specially designed Tripper serving a South African Gold Mine. Jeffrey offers a wide range of both chain and belt type conveyors to cover practically any material handling problem. Catalog 785 is virtually a handbook on this subject. Write for a copy.



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CRUSHER
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Here is a heavy duty type crusher designed for the reduction of large pieces of material in a single operation. Thus it can do the same work ordinarily done by two or more other types of crushers.

Catalog 837 gives complete details on various types of Jeffrey Crushers. Write for your copy today.

JEFFREY ...ESTABLISHED 1877

THE JEFFREY MANUFACTURING COMPANY

974-98 North Fourth Street, Columbus 16, Ohio

Houston 2

Old-timer Nick Pezzente says:

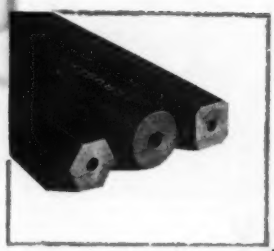
"hard rock, high air pressure, round-the-clock operation calls for

CRUCIBLE HOLLOW DRILL STEELS!"

That's Nick Pezzente, Blaster, Slattery Contracting Company, Inc., tapping a charge in the big hole for the new Chrysler Building Annex in New York City. Slattery Contracting does a major portion of the rock work around the New York metropolitan area, and Nick's an old hand at knowing by experience what it takes in drill steel to do the best job at *lowest cost per foot drilled*. He's been in this business for more than 25 years.

When the job calls for holing out hard rock, that's where Crucible *pretested* Hollow Drill Steels stand up and take it. Fewer lost bits—Crucible Hollow Drill breakage is cut to a minimum by gruelling tests on *every* lot before it gets to you.

And you get an extra when you do business with Crucible—our metallurgists and drill steel specialists can help you with those "special" jobs that take something different in drill steels. CRUCIBLE STEEL COMPANY OF AMERICA, Chrysler Building, New York 17, N. Y.



CRUCIBLE first name in special purpose steels

51 *years of* Fine *steelmaking* **HOLLOW DRILL STEEL**

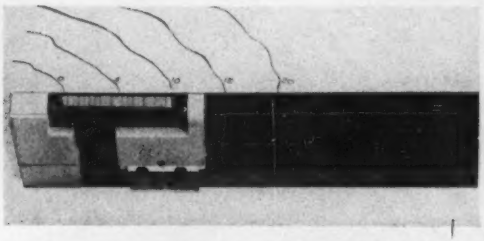
HIGH SPEED • TOOL • STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

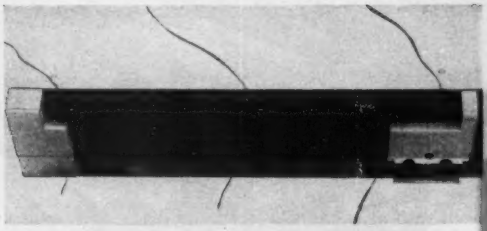
E & MJ

NEW PRODUCTS DIGEST

For further information on these products, circle item numbers on card—insert and mail.

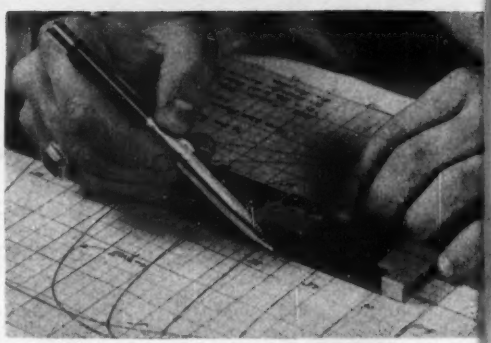
FEATURES

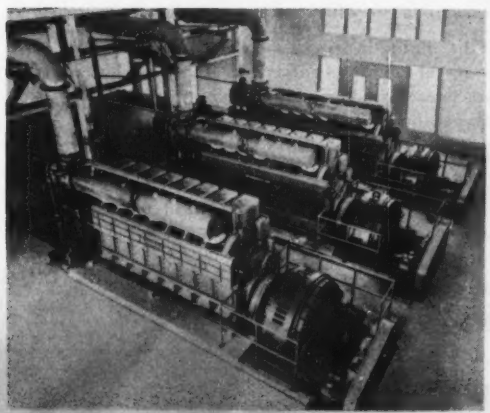




Choose Any Scale With This Rule

YOU CAN SET the Gerber Variable Scale at any scale ratio you like, for map work, construction drawings, and graphical problems of all kinds. It's done with an accurately-calibrated triangular spring fastened to a slider that rides on the scale body. Move the slider to the left, and the marked loops of the spring furnish small-scale readings (above left). Move the slider to the right, and the spring expands to give a larger scale (above right). Size of the instrument is shown at lower right. It's made by Gerber Scientific Instrument Co., Hartford, Conn. This brief description mentions only one of a great many jobs it can do. **(1)**

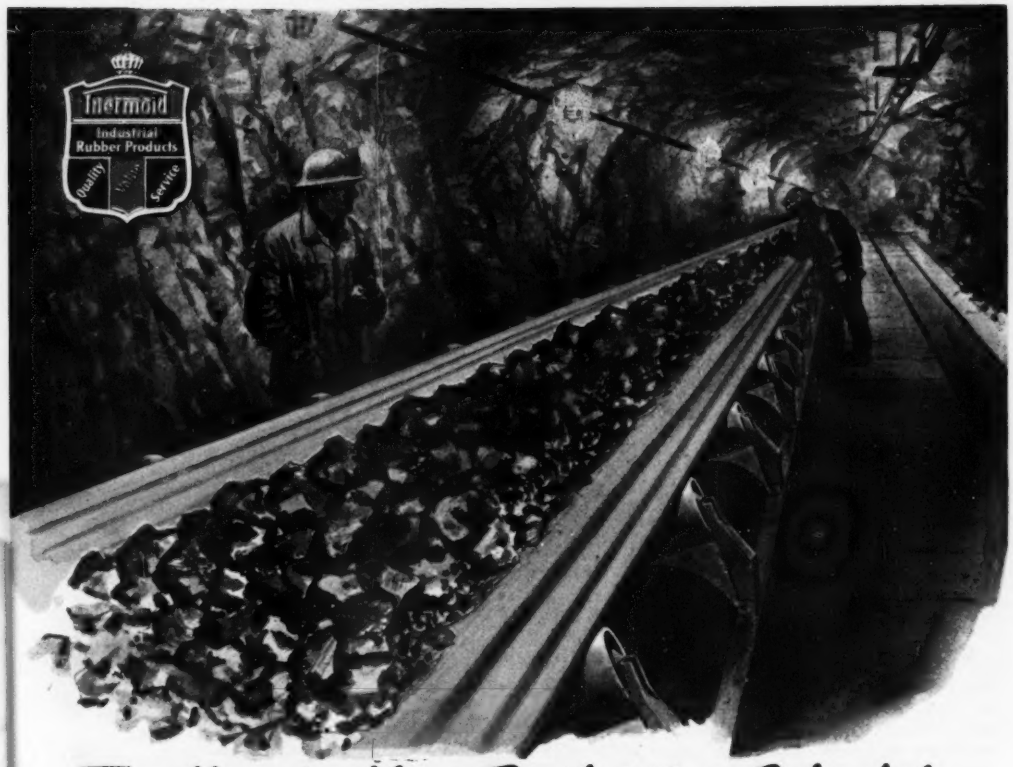




New Diesel Boosts Power One-Third

ONE-THIRD GREATER horsepower output than conventional supercharged diesel engines of equivalent size, is the achievement claimed for the new Nordberg Supairthermal diesel engine. It's done by use of the principle that the lower the temperature of air in the cylinder at the moment of fuel injection, the greater the amount of fuel that can be burned, and the higher the horsepower output without increasing peak temperature or pressure.

Made in a range of sizes from 425 to 3,200 hp. for stationary and marine applications, the new engine uses the Miller system of supercharging. Air is supercharged at higher pressure, is cooled before it enters the engine cylinders, and the intake valve is closed just before the cylinder reaches bottom dead center, which expands, and further cools the cylinder air. Nordberg Manufacturing Co., Milwaukee, Wis., will send details. **(2)**



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Drop us a line for your copy of Book No. 3679. It is a handy reference guide, concise and complete. 16 pages of valuable charts, tables and graphs tell how to select the right conveyor or elevator belt for the materials to be handled . . . how to determine capacities, speeds, weights and number of plies.

Current industrial production requirements have created the greatest demand ever made on the mining industry. This means that all tools and equipment are operating at maximum — with consequent stress and strain.

Throughout the mining industry — day after day Thermoid conveyor belting is proving its ability to stand up under this accelerated production — to move materials at lowest cost-per-ton.

Your nearest Thermoid Distributor will gladly recommend and furnish the proper belt for your installation. If you have a special problem a Thermoid field representative is immediately available to help.

Conveyor & Elevator Belting • Transmission Belting
V-Belts • Wrapped & Molded Hose

Thermoid

Rubber Sheet Packing • Molded Products
Industrial Brake Linings and Friction Materials

Thermoid Company Offices & Factories: Trenton, N. J., Nephi, Utah

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

GEIGERS AND GEOPHYSICS. A collection of pamphlets covering nearly everything in the Geiger counter and geophysical line, including such items as the Super Sniffer, the M-Scope, the Scintillometer, the Snooper, the Thyac, and the Detectron; also standards for testing radioactive ore; test kit for identifying uranium minerals; fluorescent mineral testing equipment; the B-2 magnetometer and the D-2 dip needle. Quite a bargain! From Radiac Co., New York, N. Y. (71)

VERTICAL TURBINE PUMPS. An eight-page catalog on Ingersoll-Rand's line of vertical, turbine-type pumps. Specially suited to bulk liquid transfer where suction is taken from an open source. Capacities up to 15,000 gmp and 250 psi. (72)

FLOW METER. Describes a new type of flow meter that offers an evenly graduated scale and electronic integration. Brown Instrument Co. (73)

TABLE TOPS. Masonite Corporation will give you details on use of Masonite Presdwood for the tops of Deister Diagonal-Deck tables in the phosphate plant of International Minerals & Chemical Co., Mulberry, Fla. (74)

ALL-PURPOSE EXCAVATORS. Marion Power Shovel Co. has a new bulletin showing working views of all its line of excavating machines. It's a magazine-sized job; Spanish and French translations in preparation. (75)

OXYGEN. Large or small-scale production of oxygen, nitrogen, and the rare gases, for commercial use, is described in this bulletin of Petrocarbon, Ltd., London. (76)

PRODUCTIVE MAINTENANCE. General Electric Co. announces an ambitious plan to assist maintenance engineers in setting programs to minimize lost time due to equipment failures. A well-planned kit of materials is furnished, and slide film and other aids are available. G.E. engineers will help, too, in establishing this drive for "Productive Maintenance." (77)

AUTOMATIC FLOW CONTROL. Here are the principles and the unusual features of Fischer & Porter's automatic flow ratio control system. This is the sort of thing that ought to be of interest to more mill men. (78)

BATTERY HANDBOOK. A 56-page revised edition of Gould-National Batteries' handbook on motive-power storage batteries. It has a new section on battery charging plus useful information on practically everything you'd want to know about storage batteries on your locomotives. (79)

SPEED REDUCERS. Because Cleveland Worm & Gear Co., Cleveland, Ohio, designs and builds worm gear speed reducers exclusively, they know the subject. Here's their new bulletin on worm gear drives. (80)

INDUSTRIAL FLOOR. Why engineer an industrial floor is the provocative question answered in a 12-page catalog of Flash-Stone Co., Philadelphia, Pa., which makes flooring.

FAST HARD-FACING. Spread this compound on a surface, harden it with an ordinary welding torch. Serves for tools, parts, edges, threads, dies, drills, and what-not. Bulletin tells all about it. Eutectic Welding Alloys Corp., Flushing, N. Y. (82)

CONVEYORS — CAR UNLOADERS. Lake Shore Engineering Co., Iron Mountain, Mich., has a 12-page bulletin describing its complete line of flight and belt-type portable conveyors and under-car unloaders for handling coal, coke, sand, gravel, and other bulk materials. (83)

PACKAGED POWER. General Electric Co. has prepared a 24-page bulletin telling all about the usefulness of packaged power units for enabling quick expansion of industrial plants when there isn't time to wait for a custom-tailored power plant to be designed. (84)

FLOOD DAMAGE. It's certainly worth your while to try to get a copy of a booklet made up by Columbian Steel Tank Co., Kansas City 7, Mo., which has a suite of pictures taken in and around the plant during and after the recent disastrous flood. What a mess, is the invariable reaction, and one must admire the strength of the people who have to come in and clean up after an experience like that (85)

HEAVY-DUTY TRUCKS. Many types of heavy-duty trucks, including six-wheelers, are covered in a new bulletin of Federal Motor Truck Co, Detroit, Mich. Has all the specifications. (86)

SUPER REFRACTORIES. Technical information of a basic nature on the super refractories of the Carborundum Co., Perth Amboy, N. J., is given in a new booklet, illustrated with charts, tables, and photographs. (87)

PRESSURIZED EXTINGUISHER. American-La France Foamite Corp., Elmira, N. Y. offers new literature on an air-pressurized fire extinguisher which aims and operates like a gun. To refill, simply pour in more vaporizing liquid and charge the tank with compressed air. It is claimed to be the most effective 1-quart extinguisher for class B and C fires thus far designed. It will stop small oil and grease fires quickly. For illustrated literature on this new extinguisher use convenient card below and circle. (88)

USE THIS CONVENIENT CARD

to obtain further information on products and bulletins mentioned in the New Products Digest. Circle item numbers, tear out and mail.

Not good after December 1, 1951, if mailed in U. S. or Canada.

NOT GOOD AFTER DECEMBER 1, 1951—If mailed in U. S. or Canada September, 1951

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	8	15	31	38	45	71	78	85
2	9	16	32	39	46	72	79	86
3	10	17	33	40	47	73	80	87
4	11	18	34	41	48	74	81	88
5	12	19	35	42	49	75	82	89
6	13	20	36	43	50	76	83	90
7	14	21	37	44	51	77	84	91

My Name ..... Position .....

Company .....

Address .....

Equipment Shorts

SELF-PRIMING PUMP. Just placed on the market by Chain Belt Co., Milwaukee, Wis. Sizes up to 90,000 gpm from 4,000 g. per hr. Easy to maintain. (31)

ELECTRONIC WEIGHER. Frees weighing operations from bulky lever systems and can print weights at any distance from scale. Compact, easy to install and maintain. Suitable for motion weighing of ore cars, metal slab trucks, etc. Made by Streeter-Amet Co., Chicago, Ill. (32)

CAR THAWER. Portable car thawing tubes, burning fuel oil, kerosene, etc., can loosen up a stubbornly frozen hopper-bottom car in 45 to 60 min. No installation construction needed. Made by Hauck Mfg. Co., Brooklyn, N. Y. (33)

MECHANIC'S PROTRACTOR. Handy gadget for angle-measuring problems in the shop. Good for engineers, foremen, inspectors, mechanics, sheet metal workers, etc. Price, $2.50 from Interstate Sales Co., New York, N. Y. (34)

SELF-LIGHTED LENS. A hand lens for picking out those middling grains in the vanning plaque that carries its own light. Called the Flash-O-Lens. Has a 7-power glass, built-in light source. Can be supplied up to 40-power. Costs $14.85, from Abbeon Supply Co., Woodside, N. Y. (35)

VALVE ACTUATORS. Air or liquid-operated cylinders are used to actuate gate, plug, diaphragm, or other type of valve. Work anywhere; can be set for on-off or position operation. Ledeen Co., Los Angeles, Calif. (36)

VACUUM CALCULATOR. Slide rule suitable for quick calculations in vacuum research and processing work available free from F. J. Stokes Machine Co., Philadelphia, Pa. (37)

BULK FLOW VALVE. Flow of bulk material in hoppers, chutes, and bins can be controlled by a new valve using an iris diaphragm device made by Syntron Co., Homer City, Pa. (38)

MICROSCOPES. New standards of comfort in use and quality are set by a new line of laboratory microscopes now available from Bausch & Lomb Optical Co., Rochester, N. Y. Well worth investigating, if you use a microscope a lot. (39)

NOISELESS VIBRATOR. A bin vibrator that doesn't make a sound is hard to picture, but that's the claim made for the new air vibrator made by Cleveland Vibrator Co., Cleveland, Ohio. (40)

LINE LUBRICATOR. A new size of Arnold lubricator for line-oiling of pneumatic tools. Holds ½ pint; made of light-weight alloy. Shape prevents catching on rocks when dragged. Rucker Co., Oakland, Calif. (41)

SPOTLIGHT. Bright light for dark mines could be furnished by this new 100,000 candlepower spotlight from Stonco Electric Products Co., Elizabeth, N. J. Has only 300-watt rating. (42)

HARD-FACE ELECTRODE. For all-around use where an inexpensive hard overlay electrode is wanted, Eutectic Welding Alloys Corp., Flushing, N. Y., suggests its new EuteChrom 2X. (43)

HAT SHOCK ABSORBER. For protection against blows from the side, wearers of Hard Boiled Hats can use E. D. Bullard Co.'s sponge rubber shock absorbers. Easily put in and worn. (44)

REBUILDING TRACTOR ROLLS. According to Stoody Co., Whittier, Calif., the past year has seen an enormous increase in use of automatic welding equipment for rebuilding and and hard-facing worn tractor parts. Top carrier rolls have caused some problems, because they are usually made of cast iron, not believed suitable for automatic welding. You can hard-face these rolls manually, however, by using Stoody's 1027 electrode. They'll send details. (45)

CONCRETE MIXER. For fast production on jobs needing a 6-cu. ft. mixer, Chain Belt Co., Milwaukee, Wis., offers a new Rex mixer, which features several operating and construction improvements. (46)

MINE SAW. For cutting and fitting mine timber in cramped quarters, you ought to find the new Bushman bow saw useful. It's made by Gensco Tool Division, General Steel Warehouse Co., Chicago, Ill. (47)

PLURAJET SHAPED CHARGES. Shaped Charge Explosives Manufacturers, Inc., Martinsburg, W. Va., informs us that the metal casing of the Plurajet charge, illustrated in our July issue, p. 111, is made of aluminum instead of steel as reported. However, because of the shortage of aluminum, the base and the cover of the charges are now made of plastic. Results with the plastic containers are fully as successful as with the aluminum containers. For further information, circle No. (48)

SO_2 DETECTOR. Minute concentrations of SO_2 in the air can be continuously measured and automatically recorded by the Thomas Autometer which is described in an 8-page folder recently released by Leeds & Northrup Co., Philadelphia 44, Pa. The unit is sensitive to concentrations as low as 0 to 5 parts of SO_2 per million parts of air. SO_2 detection is based on the principle of electrolytic conductivity. The unit contains an electronic Speedomax Recorder made by Leeds and Northrup. Readings are reproducible to 0.1 ppm SO_2. Integrating and non-integrating types of the Autometer are available. (49)

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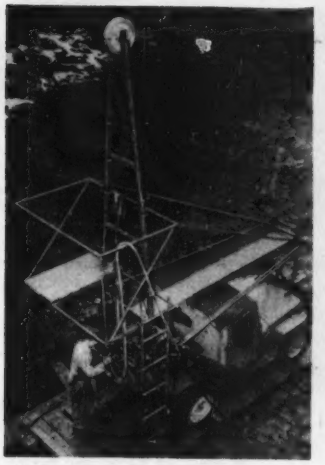
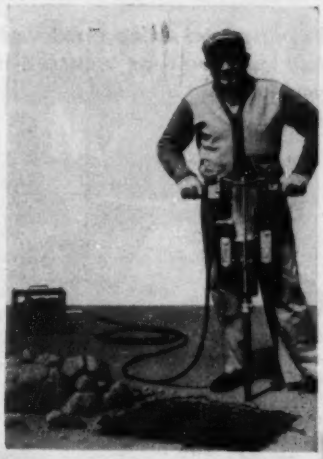
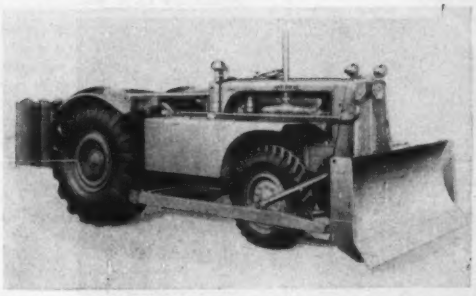


TRAVELING DRILL RIG has standard jeep carrying Boyles Bros. diamond drill with 18-ft. collapsible mast, plus 600-gpm Fairbanks-Morse pump with Briggs & Stratton motor. Rig can be taken down and set up ready for running again in one hour. Made and used by Havlick Diamond Drilling Co., Spokane, Wash. (3)

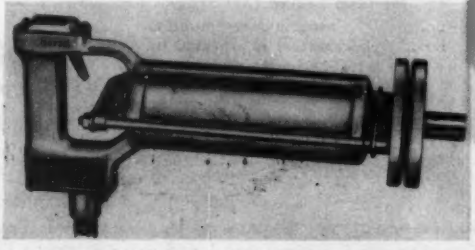
SELF-CONTAINED DRILL, powered by gasoline, now offered in an improved model featuring new ignition system, greater portability, increased operating convenience. Recommended source of ignition current is standard 6-volt auto battery. Fuel is regular gasoline. From Barco Manufacturing Co., Chicago, Ill. (4)





SMALL BULLDOZER for use with Caterpillar's DW10 tractors is announced by Caterpillar Tractor Co., Peoria, Ill. Assembly for bulldozer trunnions differs from company's track-type tractor bulldozers, and is made of heavy structural steel plate tied in with tractor frame. For bulldozer use, tractor should use 7,000 lb. counterweights. For further information check item (5) on card.

EASY COMMUNICATION between motorman and dispatcher on trolley locomotive systems in mines is furnished by Mine-Phone, a mobile communications system, shown here as installed recently by Dominion Steel & Coal Corp. in Nova Scotia. System uses inductive train communication method. Made by Union Switch & Signal Co., Pittsburgh, Pa. (6)



HIGH-SPEED HOLE DRILLING in concrete, brick, or stone is claim for new electromagnetic hammer drill. Uses a carbide-tipped, fluted steel with automatic rotation. Made by Syntron Co., Homer City, Pa. (7)

MOTORIZED HEAD PULLEY drives this conveyor belt in use at the Morrison-Knudsen crushing plant at Boise, Idaho. The pulley, made by Idaho Sprocket & Machine Works, Boise, Idaho, comes in sizes up to 60-hp. and contains within itself its drive motor and gears. (8)

NO GUESSWORK HERE!

***Experienced mill operators** know that when you select **WEMCO S-H Classifiers** your judgment is backed by six proven design features.*

1 SHARPER SEPARATION
maximum settling difference between fine and coarse particles is gained by larger **effective** pool and control of pool agitation.

2 SIMPLE HYDRAULIC LIFTING DEVICE
provides simple, foolproof operation and gives complete protection against clogging or jamming.

3 GREATER SAND RAKING CAPACITY
up to 100% increase as compared to other type classifiers is provided by **WEMCO** S-H (Special Helix) design.

4 STURDY SHAFT AND FLIGHT ARMS
tubular shaft is up to 50% larger than other machines of the same capacity; flight arms are shorter and stronger.

5 FULLY PROTECTED BEARINGS
with efficient gear drive assure dependable, continuous operation at lower horsepower.

6 LOWER WEARING SHOE REPLACEMENT COSTS
special **WEMCO** spiral design permits 25% reduction in lineal length of spiral, hence replacement costs of wearing shoes per ton of ore milled are 25% less.

*At least **one** of these reasons probably fits **your** requirements.*
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*Write today for full particulars on these **modern** machines*

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Memos from the Manufacturers

Worthington Pump & Machinery Corp.: V. de P. Gerbereux has been appointed manager of the centrifugal pump sales division. He succeeds A. H. Borcherdt, who has been elected a vice president of the company. Mr. Borcherdt will have responsibility for sale of the company's entire line of pumping equipment.

General Cable Corp.: Howard A. Reid, formerly foreign sales promotion manager of Union Carbide Carbon Corp., has been appointed sales promotion and market analysis manager of General Cable in New York City.

Hercules Powder Co.: John M. Martin has been named assistant general manager of the explosives department of the company. J. Joseph Kelleher has been made assistant director of sales of the explosives department.

John A. Roebling's Sons Co.: James C. Barney has been appointed assistant manager of sales for the wire rope division of the company. John P. Kadlic has been named Philadelphia district sales manager for the wire rope division.

National Lead Co.: The company has acquired all the capital stock of Charles Taylor Sons Co., manufacturers of special refractory materials. National Lead will operate the Taylor Co. as a subsidiary with head offices in Cincinnati and another plant in Taylor, Ky.

B. F. Goodrich Co.: Edward T. Gregory has been named manager of flat belting sales, succeeding A. Clarke Mack, resigned. He has been succeeded as operating manager of industrial product sales by D. E. Schlemmer.

Thew Shovel Co.: The National Production Authority has announced the appointment of M. B. Garber, director of sales of Thew Shovel Co., as director of the construction machinery division of NPA.

Diamond Mfg. Co.: David C. Hall has become president and general manager of the company, which makes perforated-metal sheets and parts.

Pioneer Engineering Works, Inc.: A. J. Belanger has been named assistant sales manager of the company, with headquarters in Minneapolis, Minn.

Pettibone Mulliken Corp.: The company announces a major reshaping of the sales policies of its associated companies, and the creation of two new positions: W. E. Madden, formerly vice president of George Haiss Mfg. Co., becomes director of sales of the new grouping; J. M. Hume, formerly vice president of Universal Engineering Corp., becomes assistant director of sales.

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The Victaulic name stands for pioneering and world leadership in quick, dependable piping construction. Victaulic offers a *complete method* of piping that just can't be beat! From one end of the line to the other... for almost every kind of piping job... you'll find that Victaulic's the EASIEST WAY TO MAKE ENDS MEET!

Victaulic is *not* just a quick way to hook up pipe line sections... it's a COMPLETE METHOD with a versatile line of Couplings, Full-Flow Elbows, Tees, and other Fittings. Victaulic offers wide adaptability and makes joining those pipe ends quick, easy, and economical. A simple two-bolt coupling brings pipe ends together in a jiffy; a speed or T-wrench is the only tool required. AND the Victaulic Method assures positive-locked, leak-proof joints even under extreme pressure, vacuum, or strain conditions.

Preparing pipe ends is a cinch with the "Vic" Method..."Vic-Groover" grooves 'em automatically, twice as fast as a conventional pipe threader!

On *your* next piping job — new construction, repairs, or alterations — try the Victaulic Method and you'll save time, work, and money!

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27TH VICTAULIC YEAR

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New Alcoa Plant Will Use Lignite to Produce Power

A new aluminum smelting plant, the first in history to use lignite for fuel, will be built by Aluminum Company of Amercia about 60 mi. south of Waco, Texas, in Milam County. Plant capacity will be 85,000 tons of aluminum annually. Production is expected to start in the fall of 1952. About 1,000 persons will be employed.

Although the existence of large deposits of lignite in the Milam County area of Texas had been known for years, it has been only recently that the U. S. Bureau of Mines demonstrated at its experimental plants in Denver, Colo., that low-rank, non-coking coals such as lignite could be used commercially both for low-cost power and coal tar production. According to V. F. Parry, chief of the Denver Laboratories, who supervised the pilot plant investigation, "Profits from the 14 gal. of tar recovered from a ton of Milam County lignite will enable this fuel to compete with natural gas selling at 5¢ to 8¢ per 1,000 cu. ft."

The large amounts of power required by the aluminum plant will be generated by steam-driven equipment using lignite processed by the U. S. Bureau of Mines carbonization method. A battery of twelve 575,000-ton a day units costing approximately $12 million will be needed to supply fuel for generating the power needed.

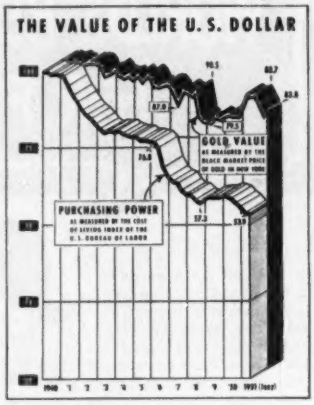
Reserves of lignite in Milam County total more than 100 million tons. Strip and slope mining costs are estimated to be about $1 to $1.50 per ton. Raw lignite contains about 7,000 Btu per lb. and about 35% moisture. The char of processed lignite contains about 10,600 Btu per lb.

For Copper Exploration

Calumet & Hecla Consolidated Copper Co. has entered into a $568,193 contract to explore for copper on numerous properties in Houghton and Keweenaw counties, Northern Michigan. The Government will contribute 50% of the cost, under the "matching" fund principle. Scheduled for completion within two years, the project will involve drifting for extensions of already developed orebodies and for surface trenching across known lodes.

Lake Boat Christened

The first of several C4-type ocean-going vessels being converted to Great Lakes freighters was christened the "Tom M. Girdler" on Aug. 16 at Baltimore. The traditional bottle of champagne was broken against the ship's bow by Mrs. Tom M. Girdler, wife of the chairman of Republic Steel. The vessel will enter the lake ore-carrying service this season. It will cost over $2 million, will provide a ship with a capacity of about 14,500 tons of iron ore. The boat belongs to the Nicholson Universal Steamship Co. of Detroit, in which Republic has a 70% interest.



Depression Ahead?

This interesting chart, prepared by Franz Pick of *"Pick's World Currency Report,"* shows how surprisingly the "gold value" of the dollar has held up with reference to the "cost-of-living purchasing power" of the dollar.

This situation is interpreted by Mr. Pick to indicate that a depression is impending whenever such artificial stimuli to our economy as the defense effort fade out, unless the Government resorts to a revaluation of gold, bringing gold values in line with purchasing power values.

Eager as we are for signs that the status of gold is improving, we do not share Mr. Pick's view that gold exercises such leverage today, hemmed in as it is by a net of regulations and by a general unwillingness to face up to the bills we are incurring. In our opinion, the continued debauchery of currencies will eventually bring the fiat money men to the end of their rope, but the "something for nothing" philosophy is still riding too high to make a near-term reckoning likely.

Minnesota Ores Studied for Manganese, Sulphur, Iron

Practical methods for recovering manganese, besides sulphur and iron, from Minnesota's low-grade manganiferous iron ore and iron sulphide deposits are being sought under the metallurgical research program of the U. S. Bureau of Mines in Minneapolis, according to Paul Zinner, regional director. The Bureau's staff at the Minneapolis Experiment Station has been increased from seven to twelve persons since the beginning of 1951. Carl E. Wood is chief of the Metallurgical Division.

Research to recover sulphur and iron from iron sulphide deposits began after Bureau engineers drilled on deposits twelve miles southeast of Aitkin, Minn., last year, and found enough ore to warrant a laboratory program.

Britain Strives to Shave Imports of U. S. Sulphur

Three years from now Britain will still be needing more than 300,000 tons of U. S. brimstone per year, according to British officials and ECA advisors in London. A U. S. export quota that will amount to about 408,000 tons this year saved British industry from disastrous cutbacks this spring. The quota made up about 55% of Britain's total raw sulphur needs. Eighteen projects of varying size have been started to reduce this dependence. However, the deficit will not be appreciably reduced until the third quarter of 1954; and even this is doubtful, because as one British official put it, bluntly, "If we give sulphur schemes a very high priority for materials, something else just as important will have to give way."

More than three-quarters of Britain's raw sulphur requirements go into sulphuric acid. The target for the next few years is a seven-fold increase in acid from pyrites, from 125,000 tons a year now to 900,000 tons a year, and 200,000 tons a year increase in acid from anhydrite.

If total consumption stayed at the present level of 1.9 million tons a year, the estimates might cover the current deficit by 1954. But ECA officials estimate that for rearming, British industries may increase their acid consumption at the rate of 200,000 tons per year—thus accounting for half the expansion program by 1954 in increased demand.

Increased production from anhydrite by 1954 promises to be little more than 50,000 tons. Production will come from two plants, one functioning, and the other planned. Imperial Chemical Industries plant at Billingham is expanding from its present production of 150,000 tons of acid per year to 175,000 tons next year, and probably 200,000 tons by 1954. United Sulfuric Acid Corp., recently formed by 11 leading British acid consumers including ICI and Coutaulds, is to build a $10 million plant at Wildness. Planned capacity is 150,000 tons.

A seven-fold increase in production of acid from pyrites would require imports of 700,000 tons of pyrites per year as against less than 200,000 tons now. Sources for this supply are not entirely evident. Spain supplies Britain with 90% of her pyrite needs. Two British companies, Rio Tinto Co., Ltd., and Tharis Co., Ltd., control most of Spain's output.

ECA, partly motivated by a desire to obtain Spanish pyrites for the U. S. A., has indicated to the British that it will provide financial aid. ECA has in mind strengthening the one-

Send in Your Steel Scrap

There is a definite danger that the current high rate of steel production will fall off sharply if additional amounts of steel scrap are not made available to the steel mills. The NPA and the Iron and Steel Institute are cooperating in a drive to stimulate the flow of industrial scrap. Now is the time to clean out the scrap at your mining or smelter properties and send it to the steel mills so that they can build up stockpiles to offset normal wintertime depletion.

track railroad that connects the mines with the sea, and building up the port of Huelva in Southern Spain. The British Government at the same time has released some dollars to the mining companies to buy modern equipment in the U. S. However, ECA points out that the British companies will have to improve working conditions and increase wage rates if output is to be increased. The British fear that the Franco Government will play fast and loose with pyrites in future trade talks by asking higher prices, and exchange of such scarce items as copper sulphate, ammonium sulphate, and steel.

The British have a good alternate source of pyrites in Cyprus which produces about 900,000 tons per year. However the bulk of the Island's output went to France, Italy, and Czechoslovakia last year.

Despite various plans for increasing sulphur sources, Britain cannot see the day when it will be independent of the large amount of sulphur imported from the U. S. A. Although ECA urged Britain as early as 1949 to seek other sulphur sources than brimstone, little has been accomplished.

Titanium Metals Corp. to Build Plant in Nevada

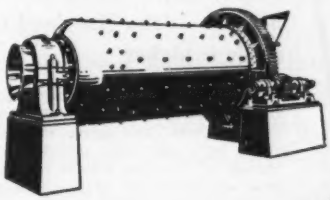
Titanium Metals Corporation of America, jointly owned by National Lead Co. and Allegheny Ludlum Steel Corp., plans to build the first large-scale self-contained plant for the production of titanium metal at Henderson, Nev. The facility, expected to be in production next year, will increase world production of the metal from the present rate of about 500 tons a year to 4,100 tons.

The cost of the plant is estimated at $14,162,000, and a certificate of necessity has been obtained for accelerated amortization of about 90% of that amount.

Leases have been secured on major components of the $150,000,000 former Basic Magnesium, Inc., plant built by the Government during World War II at Henderson. The Colorado River Commission has allowed an annual

WHAT HAPPENS INSIDE A ROD MILL?

The answer to this controversial question is thoroughly covered by Hardinge in Bulletin 25-C-1 (just off the press) on the subject of rod mills, their proper field of application, and specifically—how Hardinge Rod Mills solve some of the usual problems.



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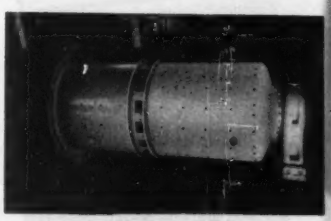

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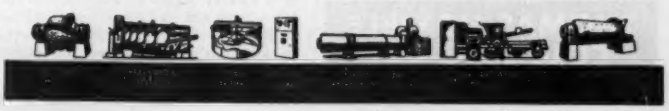

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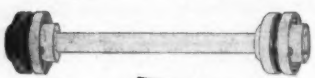

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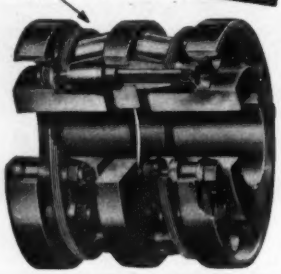

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This Month in Mining *(Continued)*

power supply of 151,000,000 kw. hr. generated at nearby Hoover and Davis dams.

Under the terms of the initial contract, production of titanium metal at Henderson will rise to some 3,600 tons a year, probably by late 1952. Raw metal will be extracted from ore and melted into ingots of 1,000 to 2,000 lb. each. The metal will be produced by reducing the oxide in the ore by the thermal-chemical batch process. Titanium oxide is first combined with chlorine to produce titanium-tetrachloride. This, in turn, is combined with molten magnesium, resulting in magnesium chloride and raw titanium metal. Both the magnesium and the chlorine can be partially recovered electrolytically from the magnesium chloride.

Forgings, bar and rod of titanium are currently quoted at $6 per. lb., with sheet and strip at $15 per lb.

Quebec-Vermont Outcrops Look Interesting

Ascot Metals Corp., Ltd., Sherbrooke, Quebec, reports that "The company has some 12,000 acres of ground astride the Quebec-Vermont boundary on which a limited amount of exploration indicates several interesting copper-lead-zinc showings." The report reveals that other holdings include 750 acres in Richmond County, Quebec, about 5 mi. from Canadian Johns Manville operations. This property produced high-grade chrome concentrates valued at about $1.5 million during World War II. The chrome bearing ground has been partially explored thus far, and mining has been confined to an orebody 500 ft. deep and 700 ft. long. The property has also good surface showings of asbestos. Large-scale production is under consideration.

IN THE UNITED STATES

CALIFORNIA

Gold-tungsten discovery reported—Idaho Maryland ore grade is higher

★**Discovery of gold** ore with commercial possibilities on the Riverside County Twin Pine ranch for delinquent boys has been added to the finding of tungsten ore in the same area announced in May. Although mineral content over the entire property has not been determined, assays of ore samples show that both tungsten and gold are present in commercial quantities. The land for the institution was purchased by Riverside County from the Federal Government, and since the County cannot file for mineral rights, three County officials have filed as individuals after agreeing to turn over any profits to the County. If further prospecting indicates that tungsten and gold are present in sufficient quantities, the three men will lease the claim to an operating company.

★**Inyo Mining Co.** is shipping tungsten ore daily to the U.S. Vanadium mill in Pine Creek, near Bishop, Inyo County, from its holdings in Eureka Valley, where it recently resumed operations. Operators of the company are C. W. Rodecker and W. R. Noack, Los Angeles, and Morris Albertoli, Big Pine, who is mine manager. The firm has 11 patented claims. Current operations are 32 mi. east of Big Pine, adjacent to the old Loretta property. In addition to scheelite, the claims contain talc, lead, silver and gold.

★**The Penn copper and zinc mine,** Calaveras County, is mining an orebody between the 400 and 500 ft. level in the No. 3 shaft area. Minerals include pyrite, sphalerite, chalcopyrite, galena and some bornite with about $5 gold and silver per ton. The mill produces a copper-lead concentrate and a zinc concentrate. The mine is operated by Penn Chemical Co.

★**Scheelite has been found** in the lower levels of Gargo Muchacho mine, Imperial County, operated by Homestake Mining Co. Occurring in the same vein as the gold ore, the grade of the tungsten ore increases as the gold ore grade decreases. Tests indicate that ore assaying 0.70 to 0.90% WO_3 can be mined. The company plans to revise the flowsheet of its mill to concentrate the ore. At present it is a 100-ton all-slime cyanide plant.

★**New Idria Quicksilver mine** near Hollister, San Benito County, is being rehabilitated. According to present plans, no scheduled production has been set up. The management plans to furnace intermittently from dumps but is not producing from underground.

★**Star-Excelsior mine in the Copperopolis district,** Calaveras County, is being operated by Trebor Corp. High-grade copper ore is being mined from lenses developed in an adit driven toward a rhyolite dike which outcrops on the hill above.

★**Idaho Maryland Mines Corp.** reports that ore mined during the first half of this year has averaged $12.79 a ton, compared with $9.38 a ton last year. In sinking the No. 60 winze from the 2,700 ft. level, good ore has been present for the 400 ft. advanced to date and occurrences of high-grade ore have been frequent.

COLORADO

Permanent buildings go up at AEC Boulder plant—Climax needs men at Leadville

★**The Silver Bell Mines at Ophir** several months ago took over the outstanding stock of the Carbonero Mines & Reduction Co. and is now rehabilitating the mine. Upon completing a road to the mine and installing compressor, ore production will be started from the 8th level or Shoofly tunnel. If sampling shows ore in the bottom of the old level, plans are to drive a 6,000-ft. tunnel from the Carbonero mill site, which will give the operation 1,200 ft. of stoping ground on five veins which have produced ore in the past.

★T. C. Moran at Breckenridge has announced that the **Standard Mining Corporation of New York** has taken a 90-day option on mines there and will do testing and diamond drilling. One of the first projects of the new company will be to unwater the workings at the **Sallie Barber mine,** which shipped large amounts of ore during the war.

★The Atomic Energy Commission reports that it has discovered a vein of **pitchblende near Fort Collins.** Thomas T. Anderson, acting regional director of the AEC, said the pitchblende find was made on private land about 45 mi. northwest of Fort Collins in the Prairie Divide country. He said the vein has been tested and found true and that the AEC geologists now are in the process of developing it.

★**The Climax Molybdenum Co.** near Leadville still needs approximately 150 employees to speed production under its five-year contract with the Government. The company has advised its employees that it will pay $15 for each new employee that they recruit. Only men between the ages of 21 and 45 inclusive are eligible. They must pass the usual screening by the personnel department and the regular physical examination. They must be willing to accept underground work, as very few surface jobs are available. In order for the employee to receive the $15.00, the new man hired will have to work at least 30 days.

★Construction of permanent structures for the $45 million **atomic production plant near Boulder** has been started by the Atomic Energy Commission. It is estimated that construction will reach a peak in 1952 with about 2,000 workers at the site.

★**At the gold placer operation at Ouray,** the water in Box Canyon Falls has receded enough to allow work to begin. A flume was built to carry the water out of the canyon, which left the river bed exposed for sluicing. C. L. Davis reports that he and his associates will go into the big trap at

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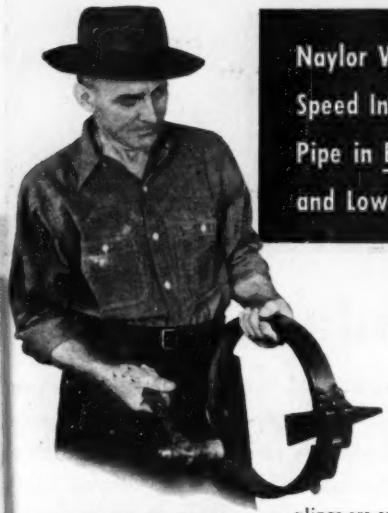

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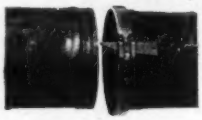

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Colorado *(Continued)*

the base of the falls when they start work this time. It is expected that this operation will net large profits in placer gold.

★Thirty-two **tungsten mine and mill operators** and Government representatives held a two-day meeting in Denver to work out details of a Federal program for increasing the nation's tungsten production.

★**Gold Mines Consolidated** of Georgetown, shipped approximately 500 tons of ore from the Terrible mine during the month of June for concentrating at the Black Eagle mill, with the concentrates going to Leadville and to Amarillo. The company hopes to maintain a production schedule of around 750 tons a month.

★Isabella Mines, Inc. says it will spend $150,000 on a development program on the **Isabella mine at Cripple Creek.** The mining firm has leased 52 acres of mining ground around the Isabella and Lee shafts. Work will be carried out through the Lee shaft. At least five sub-leasing groups are interested in working on a split-check proposition. The equipment includes new Swedish air drill machinery rated as revolutionary in mining circles there.

★**The Empire Zinc Co.** is reported engaged in testing operations on the Monte Cristo properties, the Middlesex properties and other mines located near the headwaters of the Blue River on North Star and Quandary mountains near Breckenridge. Engineers in charge of present operations state that if testing proves successful mining operations will start immediately and milling facilities will be provided south of Breckenridge.

★The Bureau of Mines has authorized exploration loans to two more Boulder County tungsten mines. The **Cold Springs Co.** at Boulder was loaned $158,210 and the **Eureka Tungsten Co.** of Englewood, with mines in Boulder County, was loaned $10,000. The loans underwrite 75% of the cost of seeking out new tungsten ores.

IDAHO

Atlas project is under way —Monsanto to have world's largest electric furnace

★After producing an average of 21,679 tons of ore per month for the first five months of the current year Sunshine Mining Co., has curtailed output to 17,460 tons **because of a shortage of skilled miners.** Among other underground deep prospecting operations Sunshine has driven the Metropolitan crosscut on the 3,100 ft. level 3,566 ft. south of the Yankee Girl vein.

★**Silver Banner Mining Co.**, a subsidiary of Coronado Copper Co. of California, has taken a lease and option on the Gold Creek Mines property west of Mullan and plans a deep development program. The property is owned by A. M. Arnold, of California, and consists of 32 mining claims which adjoin the group now being developed by Hecla, Newmont, New Jersey Zinc and Atlas mining companies.

★By a referendum vote of 91 to 65, members of the Mullan local, Union of Mine, Mill & Smelter Workers, have withdrawn from the union's district council and **refused to go out on a demonstration strike** June 20, but declared that the Mullan local "still is behind the present policy of district-wide bargaining." Sunshine and Bunker Hill & Sullivan mining companies oppose the district-wide bargaining policy, Sunshine maintaining that its employees lost time and money during the last district-wide strike although not involved in the questions at issue. Both companies are holding out for separate bargaining contracts with the union.

★Physicians and hospitals of the district notified employers of the cancellation of existing $4 per month per man **hospital contracts**, effective August 1 and are asking for an increase to $6 per month per man.

★**Highland-Surprise Mining Co.** on Pine Creek is preparing to start new stopes on three ore shoots recently opened on the 1450 ft. level according to Robert D. O'Brien, mine superintendent.

The new shoots are in the west drift and are said to be higher grade in both lead and zinc than that currently being mined from the 500 and 1,300 ft. levels, which are producing 100 tons per day with 35 men employed.

★Hecla Mining Co., in association with Newmont, New Jersey Zinc and Atlas mining companies, is **reconditioning the Atlas lower tunnel**, enlarging it and putting it on even water grade preparatory to sinking the present three-compartment Atlas shaft from the 800 to the 2400 ft. level. The portal of the tunnel is timbered with 12x12-in. creosoted square timbers and the main haulage equipped with 32-lb. rail. Several new mine buildings have been erected and the dump is being raised 3 ft. The hoisting station underground is also being enlarged to accommodate a larger hoisting plant, which has been ordered from the Coeur d'Alene Hardware & Foundry Co.

★J. L. Christian, general manager of Monsanto Chemical Co.'s phosphorus plant at Soda Springs, says the plant will produce about **10% of United States phosphorus demand** in what he says will be the world's largest electric resistance furnace. The plant will employ 125 men, use 300,000 tons of phosphate shale annually, 30,000 tons

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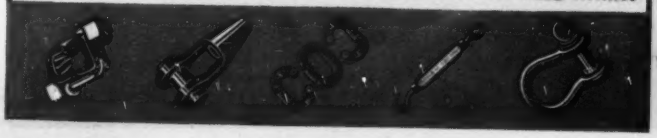

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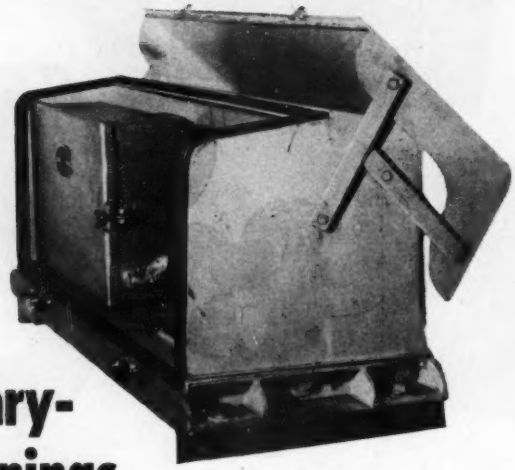

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Idaho *(Continued)*

of coke and about 600,000 kw. of electric power. The phosphate shale will be open-pit mined by the Morrison-Knudson Co. of Boise from land under lease to J. R. Simplot near the Blackfoot Indian reservation.

★**Sun Valley Lead-Silver Mines Co.**, primarily organized to develop the New Hope property in Idaho's Warm Springs district, has now acquired by purchase and option four other formerly operated mining properties in surrounding territory, including the Blue Kitten, adjoining the New Hope; Sunday Mines, 28 claims; War Dance, 5 claims, and the Silver Star group, 11 claims, in the Little Smoky district of Camas County. The company reports new development in the old workings of the Blue Kitten has opened a 3-ft. width of good milling ore. The company has recently completed installing a 100-ton mill which is now in operation on zinc-lead ore stored in old mine dumps when it was unprofitable to handle ore containing more zinc than lead.

IRON COUNTRY

NPA approves $7 million taconite plant — Expect ore shipments of 90 million tons

★**The Humphreys spiral plant at Inter-State Iron Co.'s Grant mine at Buhl**, in operation since mid-June, is expected to produce about 65,000 tons of fine concentrates this season. Feed for it comes from the old wash-ore tailings basin. The tailings are moved by a Sauerman scraper to a feeder and belt conveyor which deliver to the plant. The spiral plant, comprising 48 primary and 24 cleaner units, is to be moved to the company's Hill-Annex mine in 1952, where it will treat the wash ore tailings there.

★**Inter-State's Schley mine at Gilbert**, Minn., which began loading June 4, is scheduled to produce 400,000 tons this season. Future yearly shipments may reach 500,000 tons. About 1,400,000 cu. yd. of surface material was stripped to reach the ore. The plant is designed to screen and crush merchant ore and to wash the crushed product when necessary.

★**Dragline-conveyor stripping operations at M. A. Hanna's Morton mine** are on a 21 shift-per-week basis while shovel-truck operations are intermittent. The South Agnew is operating 18 shifts per week. More of the old Oliver dump, south of the South Agnew, is being removed to provide for the south pit bank slopes. Most of the equipment for the new South Agnew shop has already been received and set up.

★**M. A. Hanna Co.** has work under-

way on a heavy-density plant at its Mesabi Chief mine. Its Section 18 mine is doing structural drilling.

★Inter-State Iron Co. has organized a central maintenance shop to handle special work from all its mines of the Mesabi range. This is located at the Longyear mine, Hibbing, which is midway between its Schley mine at Gilbert on the east end of the range and its Hill-Annex mine on the west end. Clarence Will is foreman in charge.

★Pickands, Mather & Co. has begun proceedings to effect an exchange of 3,800 acres of forest fee lands in St. Louis County for 2,760 acres of tax-forfeited lands in the taconite formation area of northern St. Louis County.

★Predictions that this season's shipments of Lake Superior iron ore will reach 90 million tons are becoming more frequent. Up to Aug. 1 the total was 45,615,873 tons, including 1,071,485 tons from Canadian mines.

★Hanna Coal & Ore Corp. is doing exploratory diamond drilling in Becker County, in western Minnesota. Detroit Lakes is the county seat. The locations selected were among those indicated by aerial magnetometer surveys last year as likely sites for further examination. No drilling has been done in this unexplored area, which is covered by 190 to 300 ft. of glacial drift.

★National Production Authority has approved construction of the $7 million pilot taconite plant for Reserve Mining Co. at Babbitt on the east end of the Mesabi. It is expected that the building of 80 houses at a cost of $800,000 will be started this fall. At Beaver Bay, on the north shore of Lake Superior, where the large-scale plant will be built eventually, contracts have been let for relocating more than a mile of No. 61 highway and for street grading and excavations for water mains and house foundations for the homes to be built there. Reserve Mining Co. officials expect their taconite concentration program to develop with fair rapidity.

★Oliver Iron Mining Co. is preparing to extend its already large Mountain Iron open-pit mine by doing further stripping on the north side.

★W. A. Moore Co., H. E. Reese, general manager, is shipping ore from its newly opened Judson mine pit, near Buhl. The mine contains an estimated tonnage of 256,823 tons.

★Pickands Mather & Co.'s pilot taconite plant at Aurora is working steadily and producing 500 to 600 tons of pellets per 24 hr. Rated capacity is 200,000 tons per year. Results have been very satisfactory, both as to the plant and the use of its product by the furnaces.

★Development of methods to recover manganese in addition to sulphur and iron from Minnesota's re-

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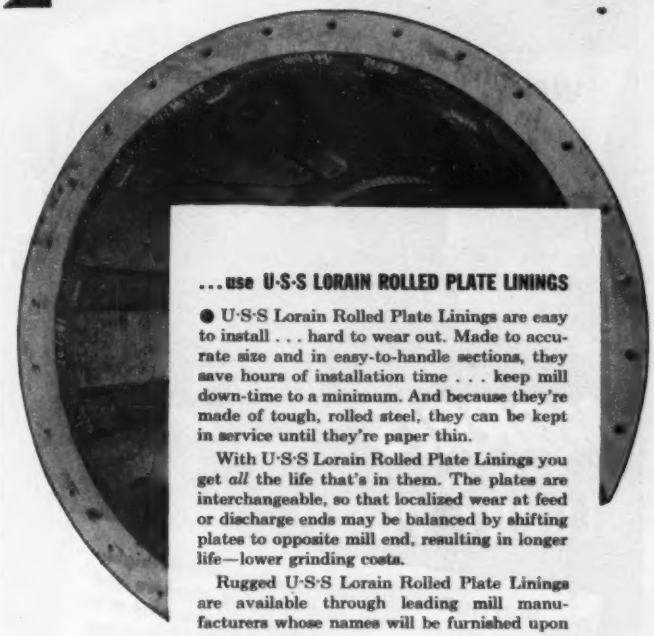

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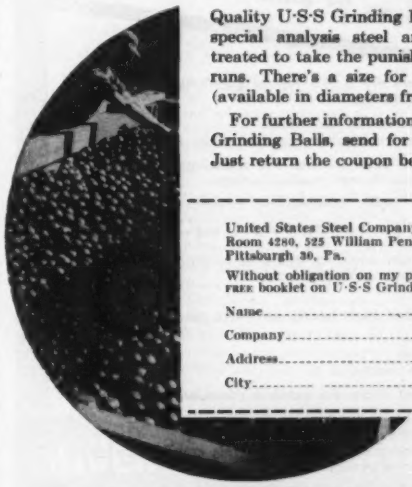

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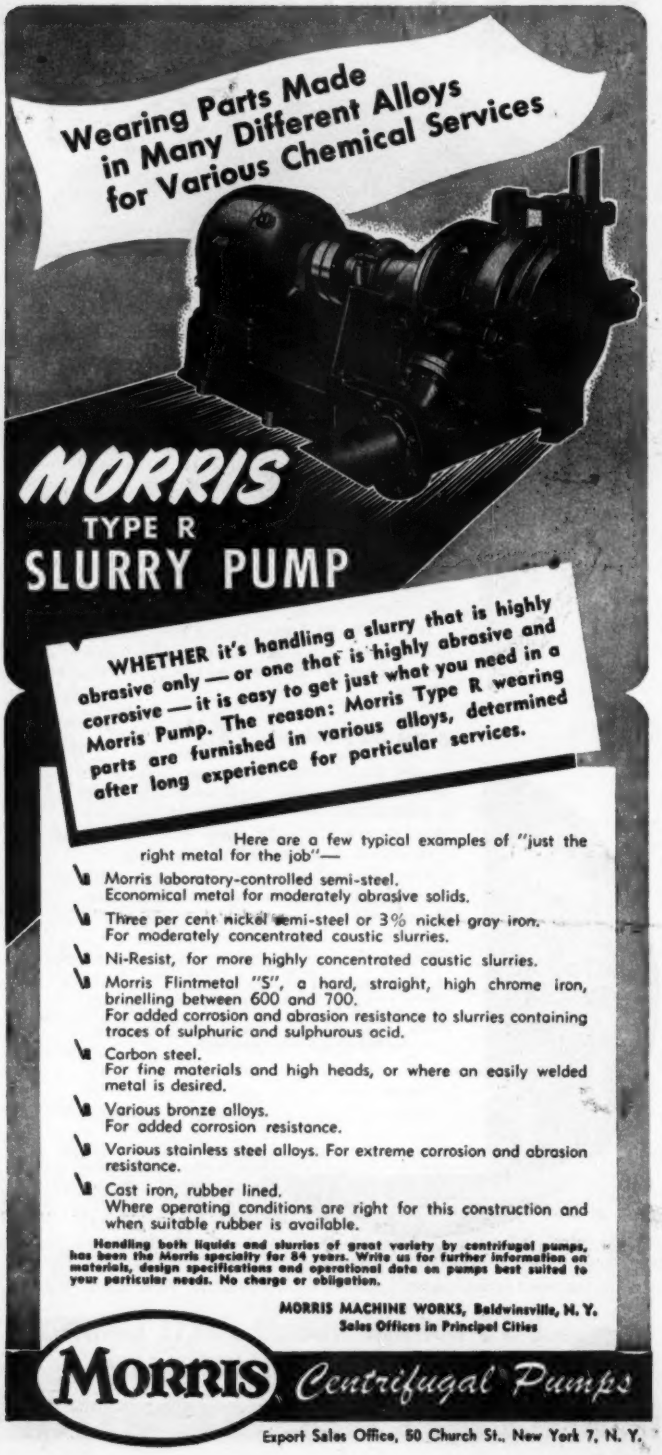
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Iron Country *(Continued)*

serves of low-grade manganese-bearing iron ore and iron-sulphide deposits are among major metallurgical research problems now being tackled by **Bureau of Mines metallurgists in Minneapolis.** Because of this research, the staff of the Bureau's Experiment Station in Minneapolis has been increased from 7 to 12 persons since 1951, Paul Zinner, regional director, said. Carl E. Wood is chief of the Regional Metallurgical Division.

Research to recover sulphur and iron from iron sulphide deposits began after Bureau engineers drilled on deposits about 12 mi. southeast of Aitkin, Minn., last year and found tonnage enough to warrant a laboratory program.

★Work is progressing rapidly at **Jones & Laughlin's Tracy mine** at Negaunee. The stockpile area is being graded and the shaft house and the mine buildings are being erected. Partridge Creek and the C. & N.W. Railroad tracks must be moved in the near future.

★Two 2½-cu. yd. diesel shovels have been delivered in the Iron River district for M. A. Hanna Co. One is loading ore at the **Richmond mine** and the other stockpile ore at the **Hiawatha mine.**

★The Proksch Construction Co., of Iron River, is constructing a combination machine shop, dry and office building; an engine house and a garage at **Inland Steel Co.'s new Cayia mine.** Concrete foundations for the engine house equipment are being installed.

★**A walkout occurred** on July 19-20 at four mines of M. A. Hanna Co. in the Iron River district due to the demotion of a trammer boss at the Homer mine to a job as pipeman. The change was caused by a shifting of other supervisory men and was not objected to by the boss who was demoted. The strike was unauthorized and was settled promptly.

★**Cleveland-Cliffs Iron Co.** at Ishpeming recently gave vacation checks two weeks early to those who desired to take vacations. The regular pay checks had been reduced due to the strike in June. Employees with a year's service received one week vacation; five-year men two weeks and 25-year men three weeks.

★Bacco Construction Co., Iron Mountain, is stripping at the old **Groveland mine,** near Randville on the Menominee Ranges, for the M. A. Hanna Co. Enough work will be done to permit mining and stockpiling 25,000 tons of the low-grade ore. Western-Knapp Engineering Co., meanwhile, is building a pilot concentration plant which is 113 x 56 x 60 ft. high. Hanna officials believe that 25,000 tons will be sufficient to determine the feasibility of operating the orebody on a commercial basis. J. B. Richardson is in

charge of construction for Western-Knapp. It is hoped to have the plant ready for operation by fall.

★Because of the dismissal of an employee who had violated a non-smoking rule in Cleveland-Cliffs' Athens mine on the Marquette range, miners at other Cliffs mines on the Marquette and Menominee ranges walked out. Some mines were closed from July 2 to 13. The strike is reported to have cost C.C.I.Co. employees more than $300,000 in lost wages. The company's no-smoking rule was modified by providing two-weeks suspension for a first offense, one month for a second and dismissal for a third. The miner dismissed was disciplined under the amended rule.

★Considerable diamond drilling is being done in the Iron River area. Some of the drills are so close to the city that its water and power lines can be used.

★Erection of the steel headframe at Pickands, Mather's Ironton mine at Bessemer on the Gogebic Range is underway. Shaft sinking is about to begin. A contract has been let for the new engine house.

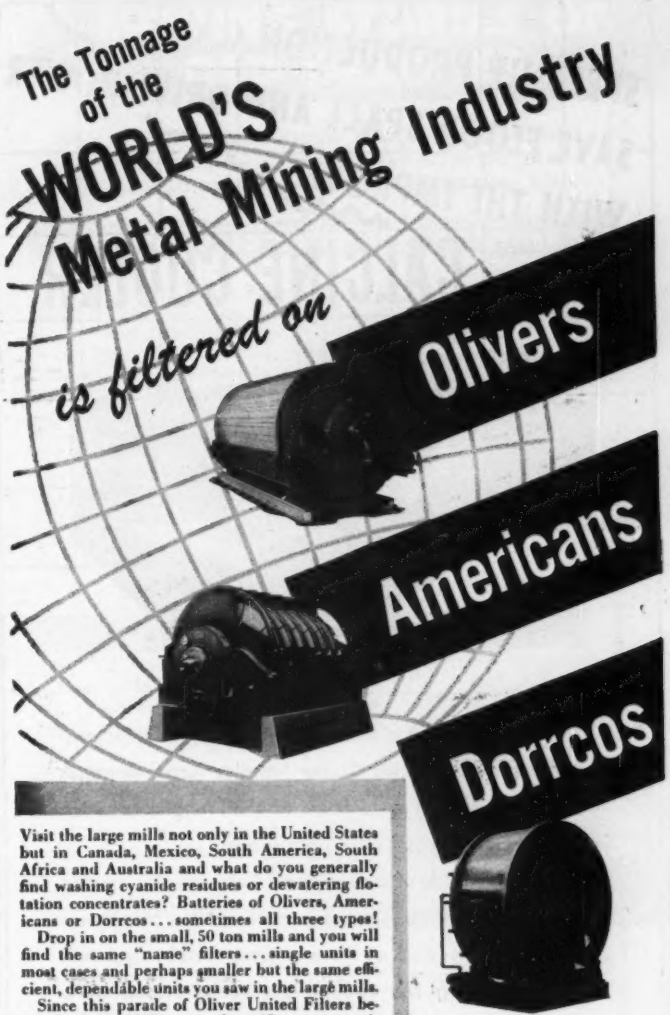
★The Wauseca mine, one of M. A. Hanna's largest producers in the Iron River district, is screening part of its ore to obtain lump running from ⅝ in. to 4 in. in size; this is popular with furnace men.

★A big lift is being given Lake Superior iron ore shippers by Canadian vessels this year. They were able to begin moving ore from the start of the season, through Congressional action. Some vessels have also been re-powered, to increase their speed. The "Wilfred Sykes," of Inland Steel Co., has been moving cargoes from the beginning and the "Cliffs Victory" is setting records for speed and carrying 14,000 to 15,000 tons while doing it. A very favorable feature is the high water in the channels this season, enabling the ships to carry the full summer draft of iron-ore cargo from the start.

MONTANA

Sierra company mines talc in Madison County — Vermiculite insulates steel ingots

★Zonolite Co., the largest producer of vermiculite in the United States, with its principal mine at Libby, Lincoln County, had a record year for the fiscal period ended March 31, 1951. Net sales amounted to $6,270,063, an increase of 35% over the preceding year. Net income was $775,905, or 79¢ per share. In the company's annual pamphlet report there is illustrated a new use for vermiculite with the following caption: "A large steel



Visit the large mills not only in the United States but in Canada, Mexico, South America, South Africa and Australia and what do you generally find washing cyanide residues or dewatering flotation concentrates? Batteries of Olivers, Americans or Dorrcos . . . sometimes all three types!

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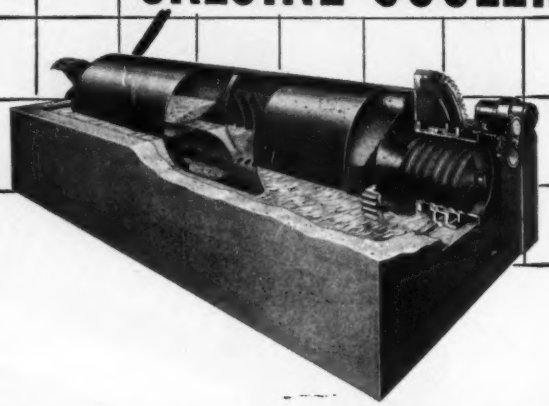

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For specifications write for the Calcine Cooler Bulletin.

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For The Mining and Process Industries

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Montana *(Contin*

company was faced \ problem of shipping hot ingots 180 mi. from their mill to the foundry. This was made possible by insulating the ingot in the freight car with Zonolite vermiculite. Previously the ingot had to be cooled before shipping, then had to be reheated. More than six weeks production time is saved by the use of the Zonolite insulation."

★Work is being carried on to reopen the old drainage tunnel of the Granite & Bimetallic Mines near Philipsburg, Granite County. The tunnel is about 2 mi. long and connects with a vertical shaft about 1,000 ft. below the surface. These workings were used a number of years ago to produce over $32 million of silver, lead, zinc and manganese ores, by a company of investors from St. Louis, Mo. The Philipsburg Mining Co. later took over the property and sold its assets about 10 yr. ago to Joseph C. Yob and Mrs. Yob. Mr. Yob was manager at that time and died in 1949. The present work is being carried on by his son, Perry Yob.

★Trout Mining Division of the American Machine & Metals, Inc., is building a flotation plant at its properties at Philipsburg to concentrate silver, lead and zinc ores. The 100-ton mill should be finished within four months. Mill construction is under the supervision of Roy Hamilton, superintendent of the company's present magnetic mill. L. B. Manning is manager of the entire operation.

★Golden Messenger Corp. has received approval for a Government exploration and development loan to operate its lead-zinc-copper properties about 7½ mi. north of Basin, Jefferson County. The company has been repairing the mine and installing machinery. Mill tests have been made on the ore. Chester Bullock, Basin, is mine superintendent.

★Near Utica, Judith Basin County, California interests are unwatering the old Gold Bug mine, a former gold producer. Rolf L. Meuer, Randsburg, Calif., is in charge of operations.

★Sierra Talc & Clay Co., Los Angeles, has taken over the steatite talc properties formerly operated by Mountain Talc Mines, south of Ennis, Madison County. Talc will be mined to supply insulators used in electronics. The new owner has made a 20-yr. contract with the Montana Power Co. to furnish electricity and a 21½ mi. transmission line is being built. Henry Mulryan, Los Angeles, is executive vice president and manager of the company and E. W. Stevens, Norris, is superintendent of Montana operations. Mr. Stevens last fall was elected president of the Madison County Mining Association, a chapter of the Mining Association of Montana.

NEVADA

Tungsten production accelerated—12-ton mill to process manganese at Three Kids

★Development of a silver-lead mine in the Galena Hill district 20 mi. south of Reno has been started by the **Constant-Willard Corp.**, Reno. H. Victor Burgard, of Carson City, is engineer and consultant. The same properties produced some silver and lead ore in early days but have long been inactive. Bulldozers are reopening roads to several old tunnels and preparing stripping operations. A 900-ft. tunnel will be reopened to develop silver-lead orebodies.

★**Two successful tungsten mines** in the Cherry Creek district of White Pine County are now being operated by Boundy & Cleghorne. At the Chance Mine three men are mining about 15 tons daily. At the Ticup mine nearby, four men are producing about 40 tons daily. Boundy & Cleghorne operates its own 50-ton mill.

★Ten tons of ore per day are being produced at underground operations of **Scheelite Chief Mine** in White Pine County, which is owned by the Minerva Scheelite Mining Co. Ore is concentrated at a 25-ton mill. Robert Stopper, Ely, has charge of the work.

★Open-pit production at the **Conquest mine in Lander County** is 18 tons of tungsten ore daily. Gale G. Peer is owner and operator. Underground operations are also being developed.

★**Shipments of tungsten ore have started** from the T-Bone mine in Lander County. F. D. Shuck is in charge of the property. All vein material shows scheelite assaying from 0.2% to 2½% tungstic oxide. Five miles of road have been constructed from Route 8-A to the mine, which is at an 8,000-ft. elevation. The tunnel site has been graded out, machinery is on the ground, and a crosscut shows a 4-ft. vein with a 15-in. vein alongside, and a 2-ft. vein 7 ft. away, all running parallel. The ore will be milled at Bishop.

★**A tungsten discovery** has been made by T. J. Niceley in Jett Canyon in Nye County. Two men are engaged in surface work and repair. The scheelite deposit appears to be of considerable extent, occurring as a well-defined vein in the face of a towering bluff.

★Mr. and Mrs. E. S. Babcock are **developing a tungsten deposit** at Flying Cloud mine near Hawthorne. Returns on assays made at the University of Nevada show samples ranging as high as 15.2% tungsten trioxide, plus gold and silver values. A road is being constructed to the mine.

★**Shipping of 1,000 tons of iron ore** daily is expected to start soon from

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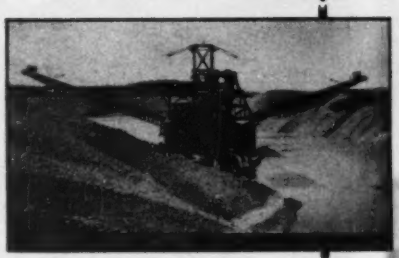

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Capital No. 2 (later Biggs No. 2), built in 1906 as YCGF No. 3, has been redesigned and rebuilt 3 times and used in three different areas with digging depths changed as needed from 60 feet to 50 feet, then to 47 feet below water. Bucket speed was increased from 18.6 to 22.8 feet per minute; bucket capacity increased from 7 to 9 cu. ft., and daily average running time upped from 18.3 to 22.1 hours.

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E & M J REPORT

MIDDLE CONGO lead prospect is tested through Marshall Plan aid.

COPPER MINE at Mindouli, French controlled, will get close examination.

ECA Funds Help Finance Search For Ore In French Equatorial Africa

FINANCED BY ECA ADVANCES of about $4,200,000 in dollars and counterpart francs, an intensive search for copper, lead, and zinc has begun in French Equatorial Africa. The advances will be repaid in metals for the U. S. stockpile if minable deposits are developed.

The project is one of the biggest the ECA has thus far financed in French territory. Directing the search will be the Mid-African Exploration Co., a combination of Newmont Mining Co. of New York and the French companies, Explorations Minieres au Congo and Societe Miniere du Niari.

Areas to be explored are in the Niari Basin in the Middle Congo. The first, at Mindouli, is controlled by a French Government corporation. The second, farther west near M'passa, is controlled by the Cie. Miniere du Congo Francaise. The region is inaccessible except by air and by the Congo-Ocean Railroad, which runs from Brazzaville, capital of French Equatorial Africa, to Pointe Noire, the country's main port.

The natives knew about the Miari copper deposits long before the arrival of the French a century ago. H. M. Stanley of Stanley-Livingstone fame reported the copper. Mining has never gone beyond the primitive methods pictured above, however, and very little is known about the extent of the deposits. The ECA-financed activity should change all that.

Nevada *(Continued)*

the iron district on the east side of the Humboldt range in Pershing County. Mineral Materials Co., Alhambra, Calif., has announced plans to employ 30 men on the project. The ore will be sent to a coast port at the rate of 20 carloads daily.

★A new 100-ton mill to process gold, silver and lead ore has been completed near Mina at the edge of the Columbus marsh to treat ore in the Candelaria, Columbus and Marietta districts.

★A 300-ft. tunnel has been completed at the Alexander silver-lead-zinc property in Esmeralda County. The property is owned and is being worked by Leo Coleman, LaFayette, Calif., and the Molini brothers, former Tonopah mine operators.

★Construction of a 1,200-ton flotation mill has been started at the Three Kids mine in Clark County for the processing of manganese ore. The work is being done by Manganese Inc., of which George Brown is general manager. McNeil Construction Co. has the contract.

NORTH CAROLINA

USGS studies Spruce Pine area—New committee on stream pollution

★A survey of the Spruce Pine mineral district, started by the U. S. Geological Survey in 1941 but interrupted by the war and resumed in 1945, was continued this summer. Dr. J. Lawrence Kulp, instructor in geology at Columbia University, is again in charge. He is being assisted by Donald Probst of the USGS; Donald M. Carr of Columbia University; and Bryon Sheldon, geology graduate from Earlham College, Indiana.

An area of approximately 380 sq. mi. between Mount Mitchell and Grandfather Mountain is being surveyed and mapped. Dr. Kulp reported in July that alaskite deposits disclosed to that date far exceeded the previously published estimates. Feldspar, fine mica and practically iron-free silica sand are recovered from these deposits by three froth-flotation plants in the district. A fourth plant at Spruce Pine was expected to be in operation in a few weeks.

The survey is also disclosing previously undeveloped deposits of mica, feldspar, kaolin, olivine and kyanite.

★Southern Minerals, Inc., headed by Phil Barbour, former Montana mining engineer, is seeking a $63,000 Government grant to explore monazite deposits in Rutherford, Cleveland, Burke and McDowell Counties. The company is licensed by AEC to possess up to 500 tons of raw material containing thorium, and to use certain patented processes for removing the various earths from monazite.

The area in question was an important source of monazite from 1886 to 1911, subsequently losing out to richer deposits in Brazil and India. The ban by India on the export of monazite and Government control of Brazilian production have led to new interest in the N. C. deposits.

★Dr. C. G. Brennecke, head of the Electrical Engineering Department at N. C. State College at Raleigh, and two associates have just been granted a patent on a safety device to prevent mine roof falls. The patent covers apparatus and methods for testing the strength of the rock structure of the roofs to identify unsafe rock. An electronic device indicates the solidity of materials and the presence of cracks. Co-inventors are Robert T. Gallagher, geophysicist and professor of mining engineering, and Robert D. Currie, mining engineer and safety expert, both of Pennsylvania. The trio began work on the device about six years ago under sponsorship of the General Reinsurance Corp. of New York.

★Governor Kerr Scott has announced appointment of six members to a State Stream Sanitation Committee created by the 1951 State Legislature and empowered to curb stream pollution. Those named by the Governor to the new body include: Mayor Scott B. Berkeley of Goldsboro; State Representative J. Vivian Whitfield of Burgaw, sponsor of the 1951 stream sanitation bill; Mrs. G. W. Cover of Andrews; W. P. Saunders of Robins, and Carroll Rogers of Tryon; and H. Grady Farthing of Boone, former state senator and district game supervisor.

The 1947 and 1949 Legislatures defeated attempts to enact a stream sanitation law with teeth in it, but the measure passed during the 1951 session.

★The summer meeting of the Tennessee Valley Section of the American Ceramic Society was held at Spruce Pine in July, with 125 members from North Carolina, Georgia, Alabama and South Carolina attending. Speakers included: Irving W. Gower, mineral research assistant, N. C. State College, who described the role of spodumene as an auxiliary flux in a sanitary ware body; G. D. White, holder of the fellowship at State College sponsored by Western North Carolina mineral interests, who dis-

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North Carolina *(Continued)*

cussed the investigation of the fusion and physical properties of kaolin-feldspar mixes; and S. T. Henry of Spruce Pine.

The final day of the meeting was devoted to inspection of various mines and processing plants in the district.

★**The Great Western Mining Corp.** has opened an office in the Skyland Hotel at Hendersonville. Recently chartered in North Carolina with authorized capital stock of $100,000, the company mines strategic ores in Yancey County. The office at Hendersonville will do assaying work and exploration. H. J. Carson is engineer in charge of metallic ores, and Clay W. Watkins is in charge of the development of non-metallic ores.

★A feldspar flotation plant under construction at Spruce Pine for the Carolina Mineral Co. is nearing completion and operations should begin within a few weeks, according to R. W. Lawson, president of the company. The plant will have a capacity for processing between 150 and 200 tons of alaskite a day, and will employ 40 to 50 persons when operating at capacity.

★**Fire damage** at the main plant of the **Feldspar Flotation Co.** at Spruce Pine on July 30 was estimated at approximately $150,000. Flames destroyed the wood and metal building and damaged most of the machinery, but were prevented from spreading to the nearby English Mica Co. plant. The fire broke out on the roof above a drier and enveloped the entire building, forcing some 70 employees to flee. Company officials said work would be started immediately to rebuild the plant. The office building was not involved.

OREGON

★David White, geologist of the Portland office of the Oregon State Department of Geology and Mineral Industries, has been appointed temporarily to the department's **Grants Pass field office** to assist in answering inquiries from prospectors and others interested in mining. **The flood of inquiries** was largely due to a revival in chromite prospecting, following the Government's announcement of the opening of a chromite ore receiving station at Grants Pass.

★Testing work on **pozzuolanic materials** is being continued at Oregon State College under the direction of Prof. C. O. Heath. New samples of volcanic ash have been provided by pumice producers of Bend and the Oregon geology department. Bauxite samples also are being tested.

★**Two carloads of copper ore** have been shipped to the Tacoma smelter by Strategic Minerals, Inc., of Medford. The ore was mined in the John Hamlin property on Onion Mountain in the Grants Pass area.

UTAH

New Park exploring in DMA approved projects—Bullion Monarch finds uranium

★Exploration work is underway on three **New Park Mining Co.** projects at Park City approved by the Defense Minerals Administration on a joint participation basis. The program calls for exploration in the Star Tunnel area off the present Mayflower Tunnel and north of the Pearl fissure. The search for lead-zinc ores calls for 300 ft. of new tunneling, plus 3,000 ft. of reconditioning before a 1,400-ft. crosscut is made to the southeast into the Morgan and Humbug formations.

Park Utah Consolidated Mining Co. will participate in maintenance of the Star Tunnel, which it in turn will utilize for crosscutting into the ground of its affiliated Naildriver Mining Co.

A second project calls for 900 ft. of drifting northeast and southeast of the Mayflower Tunnel 800 ft.

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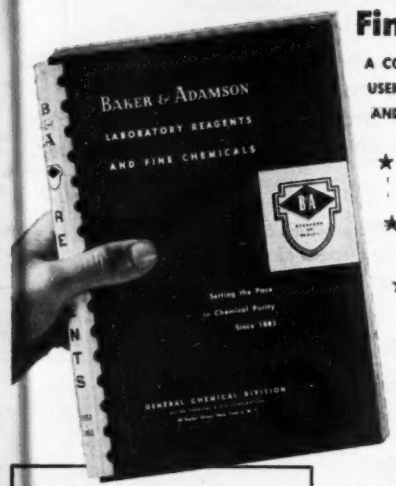

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below the Star. This work has as its objective possible ores in the Mississippian limes.

A third project east of the Mayflower and north from ores in the Pearl fissure calls for a 900 ft. extension seeking to crosscut three possible ore-bearing fissures.

★**Bullion Monarch Mining Co.**'s secretary-treasurer, R. N. Cooper, has reported a large find of uranium-bearing autunite ore near the surface in the company's Marysvale operations. The find is the second such near-surface discovery on the Utah property.

Bulldozing on the Farmer John No. 1 claim some 300 yd. northeast of the present open-cut workings is reported by Mr. Cooper to have uncovered a 50x30 ft. autunite bearing area, seemingly as large as the original autunite find on the Farmer John No. 3 claim. Shipments of ore, rated at .1 and .2% are already underway to the AEC purchasing depot.

WASHINGTON

Mead plant to start producing magnesium — Kaiser plans gypsum plant

★**Pacific Northwest Alloys**, a subsidiary of Chromium Mining and Smelting Corp., started tuning up the ú20 million Government-built magnesium plant at Mead on August 1, in preparation for production the following week. The plant was recently rehabilitated by the Morrison-Knudson Co. at a cost of $1.5 million. It is to run at about one-fourth capacity at first, but full production is expected by the first of next year, with approximately 1,200 men employed. Magnesium will be extracted from calcined dolomite brought in from Stevens County. Dana P. Blake is the newly appointed general manager.

★Aluminum Company of America, building a $50 million plant at Wenatchee with yearly production capacity of 170 million lb. of aluminum, has awarded the Westinghouse Electric Corp. **a $3 million contract** for 24 ignitron rectifiers, transformers and other electrical equipment. Announcement was made by Walter J. Maytham, Pacific coast western manager for the Westinghouse company.

★**Black Warrior Mining Co.** has been granted a $100,000 exploration loan by DMA, the tenth in the Northwest to be approved, according to Frank Funkhouser of Spokane. Approval of five loans in the area had been announced earlier. The property is near Howe Sound's copper mine in the Chelan district. The company has spent $100,000 in development and has about 75,000 tons of copper-silver-lead ore blocked out.

★George Nemi, contractor of Olym-

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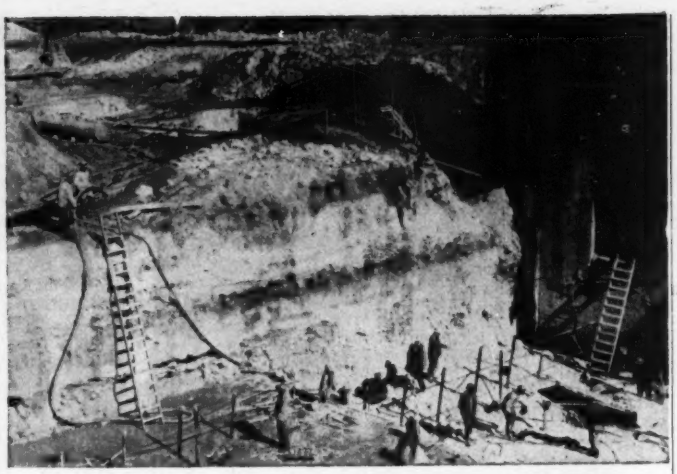

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Washington *(Continued)*

pia, and other coast men who hold a lease and option on the **Frisco Standard mine** in Stevens County, are planning a $250,000 development program with year around mining, according to Ray Chitwood of Spokane. A mill is also included in the plans. Over $20,000 was spent last season in exploration and diamond drilling.

★Joseph Gray, Ernest Oberbillig, and Gilbert Pearson have combined initials of their last names to call their company **GOP Antimony Corporation.** The group has rehabilitated the old American Graphite and Metals mill near Omak, which had been closed for two years, and started operations early in July. Raw materials are being brought from the following properties leased in northern Washington: Lucky Knock, north of Tonasket; the Bales, near Carlton; and the Queen, between Carlton and Methow. Shipments will be made to paint companies in the East.

★**Kaiser Gypsum,** a Henry J. Kaiser company, announced plans to build a $2.5 million factory in Seattle, where a tidewater tract has been purchased for the site. It is reported to be the first complete gypsum products plant in the Northwest.

★It is reported that production will soon begin at **the Lead Hill property** in the Slate Creek area of the Metaline district by American Zinc, Lead & Smelting Co. Marshall W. Scott has been directing a seven-man crew at the site. Ore will be trucked to the company's Grandview mill.

★**The 1951 convention of the Northwest Mining Association** will be held at the **Davenport Hotel** in Spokane on Nov. 30 and Dec. 1, rather than two weeks later, as previously announced.

WISCONSIN-ILLINOIS

★**Three more contracts** have been approved by Defense Minerals Administration for exploration assistance in the search for lead and zinc deposits in the upper Mississippi valley region of Wisconsin, Illinois, and Iowa. These contracts under which the Government matches 50% of exploratory costs were negotiated for the companies mentioned below.

★**Calumet & Hecla Consolidated Copper Co.,** Calumet, Mich., for exploratory churn drilling for a total of 81,250 ft. on lead-zinc properties involving 29 mineral leases and 6,000 acres, most of them in LaFayette County, southwestern Wisconsin. Total cost of the project is $158,518.

★**Vinegar-Hill Zinc Co.,** Platteville, Wis., driving 1,300 ft. of crosscuts from the East Black Stone lead-zinc mine to the Hancock orebody, and 500 ft. of drifting in the Hancock orebody, LaFayette County, Wis. Total cost of the project will be $45,704. Because of the excessive size of the proposed drifts, the Government is contributing only 35% instead of 50% of the cost.

★**Dodgeville Mining Co.,** Madison, Wis., exploratory churn drilling for a total of 7,500 ft. in the I. E. Weigel zinc property, Iowa County, Wis. Total cost of the project is $10,000.

ALASKA

★Alaska Freight Lines, Inc. has sent William O'Neill of Anchorage to direct a crew of 6 doing preparatory work on a property at Glacier Creek in the McCarthy-Nazina area. In July diamond drilling was started to search for copper in that district, according to an officer of the company.

★S. H. Lorain, director of the U. S. Bureau of Mines at Juneau, who is optimistic about the **revival of base metal mining** in the Territory, said the 8 applications for DMA assistance were all good sound propositions. The first DMA application to be approved, he reported, was that of U. S. Tin Corp., on Seward Peninsula.

★**Native Bismuth, Inc.,** is developing a prospect on Charley Creek, out from

Nome, and equipment was being set up this summer. The incorporators of the company are O. A. Margraf, previous owner of the property, David M. Russell, W. E. McDonald, Ignacy Kowalski and W. J. Russell, all of Nome. Capitalization was $300,000.

IN CANADA

Barvue Mines to mill 4200 tons daily—Open Matarrow lead-zinc mine in Ontario

BRITISH COLUMBIA

★Defense needs have brought to four the number of tungsten operations in prospect for British Columbia. Canadian Exploration is bringing back into production the Emerald Mine near Salmo for the Canadian Government, and Western Uranium Cobalt Mines is planning tungsten production later this year with a 75-ton mill on the Red Rose property near Hazelton leased from Consolidated Mining & Smelting Co. Arrow Tungsten Mines is developing property on Stewart Creek near Ymir, with diamond drilling proposed to test for parallel orebodies. Columbia Zinc and Lead Mines is considering reopening a 50-ton tungsten mill built underground between the 8 and 9 levels during the last war on its property 20 mi. east of Revelstoke.

★Canadian Exploration Ltd., developing the **Jersey Lead-Zinc mine** adjoining the Emerald, obtained net smelter returns of about $802,000 after production of 5,394 tons of lead and zinc concentrates from 44,176 tons of ore grading 1.93% lead and 5.73% zinc, during the three months ended June 30. The mill is now treating 15,000 tons of ore a month but this will be increased to 21,000 tons by the end of August. The company reports encouraging results in exploratory diamond drilling for tungsten ore outside the area sold to the Canadian Government but still within the Emerald property.

★First shipments of **British Columbia iron ore** to be made to the Orient were due to leave Vancouver Island in August bound for Japanese steel furnaces. The shipments are from Quinsam Lake property, developed by the Argonaut Company Ltd., subsidiary of the Utah Construction Co., San Francisco, which has spent about $3 million in building wharves, roads, mill, and preparing for strip mining operations. It is expected shipments of concentrated ore will run at a rate of 80,000 tons a month once operations get fully underway. Argonaust, which has proved up a large tonnage at Quinsam, has located further deposits due west of the original discoveries, and is examining Texada Island ore for Texada Mines, Ltd., which recently acquired the properties.

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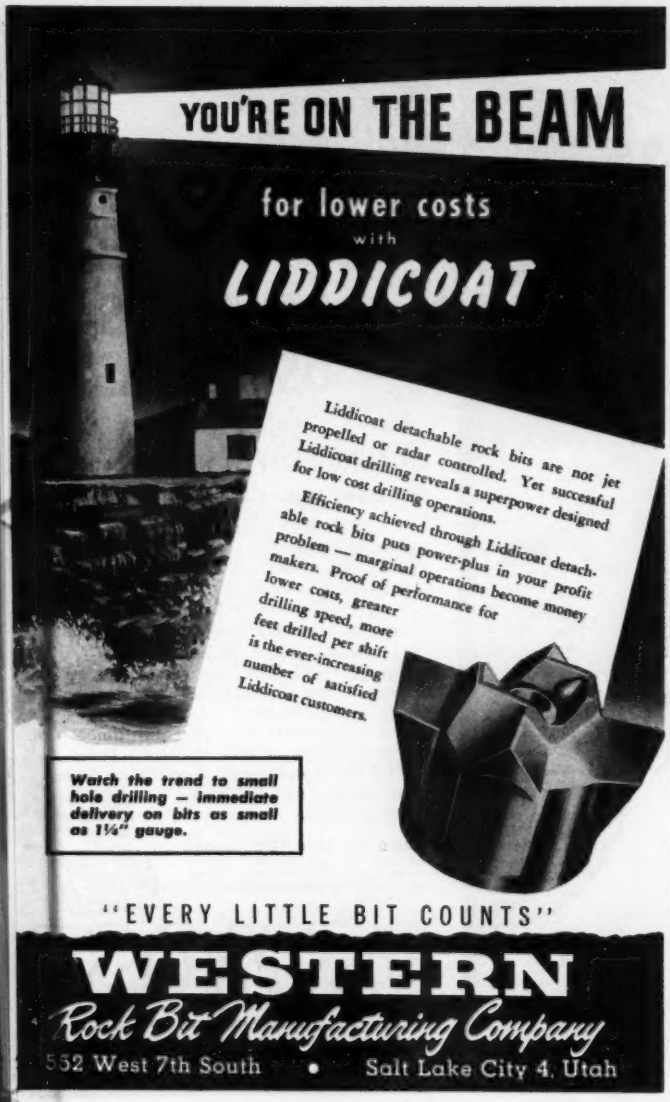
★**Magnetite ore** of excellent grade and practically free from impurities is being proven by Quatsino Copper-Gold Mines at its property on Elk River in the Quatsino mining division on Vancouver Island. Indicated and proven ore reserves are estimated at 542,000 tons of commercial grade, sufficient to justify building of a road and shipment of ore. Drilling to date has been only to a depth of 200 ft.

★**No. 3 level crosscut at Van Roi Consolidated Mines** silver-lead-zinc property in the Slocan district has reached the new southwest orebody indicated by drilling early this spring. Six holes in section show the metals over 5 ft. in width. The sink-float plant is about 25% finished and the whole mill project 40% complete.

★**A second conveyor system** now is under construction at Consolidated Mining & Smelting Co.'s Sullivan mine at Kimberley and will extend by 1,800 ft. the present 2,600-ft. conveyor. The combined system, to be in use this summer, will hoist ore a vertical distance of 1,000 ft. The first conveyor, completed in 1944, moves ore on a 7-deg. slope from the 3,350 ft level to the 3,900 ft. level. Sullivan mine has a flat-dip orebody about a mile long and up to 300 ft. wide.

★**Granby Consolidated Mining, Smelt-**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British Columbia *(Continued)*

ing & Power Co. reports ore milled during the second quarter totaled 421,166 tons against 463,252 for the previous quarter. Copper output increased from 6,513,291 lb. in the first quarter to 6,950,078 lb. in the second quarter.

★Highland-Bell Ltd., operating a lead-zinc mine at Beaverdell, has voluntarily increased wages by 50¢ a day because of the advance in the cost of living. This established the miners' rate at $11.76 a day. The increase is for all employees at Beaverdell.

★Work has been resumed by Silbak Premier Mines, in the Portland Canal district, on the construction of an aerial tramway from the terminal at No. 2 portal of the Indian Mines property to the Silbak Premier mill. Work is under the direction of Dale S. Pitt, managing director of Silbak Premier, which will operate the mine and mill ore under an agreement with Indian Mines.

★Kootenay Belle Gold Mines has started an underground development program to provide ore for winter operations when dump material is not available. The work is underway on the Altoona, Monitor and Whitewater mines, three of seven silver-lead-zinc properties acquired by the company near the Whitewater mill at Retallack. Kootenay Belle's second heavy-media separation plant is swinging into operation on the Richmond-Eureka property near Sandon and will have a capacity between 600 and 800 tons daily.

MANITOBA

★Lee Gordon Mines reports negotiations are underway to conduct further diamond drilling on its Vamp Lake property, and also on the adjoining ground held by Femco Mines. Surface samples from the Femco property assayed high in gold and base metals. The proposed program calls for drilling to continue through the winter in order to test zones under the lake.

★Camwe Snow Lake Mines reports diamond drilling is in progress on two properties in northern Manitoba. One drill is investigating a scheelite showing near Burns Lake while the property located near Flin Flon is being drilled for copper, zinc and gold.

★Callinan Flin Flon is reported to be negotiating for a share interest in two companies holding property in the Flin Flon area.

★San Antonio Gold Mines and its subsidiary, Forty-four Mines, report recent depth development results as very encouraging. The San Antonio development program involves opening of 10 new levels from the 16th to the 25th. The farthest advance has been made on the 17th level, with indicated tonnage approaching that developed on the 16th, which was one of the best levels in the mine. The 18th shows ore widths running up to 60 ft. Grade of ore in the new headings is holding close to mine average, about ⅓ oz. The favorable ore zone enters the Forty-four ground at around the 18th level, and becomes progressively longer at deeper horizons. It will be several years before the full ore potential on the new levels is realized. San Antonio owns over 70% of the issued capitalization of Forty-four Mines, and will mine and mill the ore developed on Forty-four ground.

ONTARIO

★Production from the McKim mine, started this year and stabilized at 500 tons daily, is responsible for record output in the first half of 1951 by Falconbridge Nickel Mines. Tonnage at the main property has been reduced somewhat, but McKim, small brother of the original operation, has more than offset this.

Falconbridge's third nickel-copper mine in the Sudbury area, the Hardy property at Levack, is making progress, too. The shaft, slated for initial depth of 1,000 ft., is down well over 200 ft. on its way to open up the ore-bodies outlined in surface drilling.

★**Silver-Miller Mines,** in the Cobalt camp, earned 40.3¢ per share in the year ended April 30, 1951. Production during the year totaled 1.9 million oz. of silver and 82,524 lb. cobalt.

★**Cobalt Lode Silver Mines,** neighbor of Silver-Miller, is also doing well. By mid-year the company's cumulative total of silver production passed the 1 million-oz. mark, with a corresponding record of 79,000 lb. for cobalt. The mill, started late in 1950, is handling more than 2,300 tons monthly, averaging close to 80 tons daily.

★**Ontario's first asbestos mine** is now in full production. Located near Matheson in the Munro area, Canadian Johns-Manville Co.'s mine and mill are operating at capacity of 1,650 tons daily. Production was started a year ago last June on a test basis, and has been stepping up gradually since that time.

All production at present is from the "A" orebody, estimated to contain 10 million tons to a depth of 300 ft. Two other orebodies of apparent importance have been partially drilled, one of which, the "B", is thought to have even greater possibilities than the "A". The latter, however, is adequate for 7½ years' production at current rates, all by open-pit mining.

★Although Ontario has been Canada's leading mineral province for more than four decades, it has never been important as a source of lead or zinc. Considerable interest, therefore, attaches to the deal made this past summer by Matachewan Consolidated Mines and Matarrow Lead Mines. The Matachewan company is going to finance the Matarrow property to production.

The property, opened so far only on one level at 150 ft., is in Yarrow twp., about 4 mi. from the Matachewan mine (a gold operation) in Powell twp., both in Sudbury mining division. About 130,000 tons of ore has been indicated above the 300-ft. horizon with **combined grade of 10% lead and zinc.** Further development funds will be supplied by Matachewan, a Ventures subsidiary, and eventual profits will be divided 50-50 after all funds supplied by both companies have been repaid. The ore will be treated in the Matachewan mill, part of which will be adapted for that purpose on a minimum basis of 200 tons daily. Matachewan's own gold ore reserves are declining and the whole mill, a 1,000-ton installation, is no longer required for the company's own use.

★**Kerr-Addison's 2,200 ft. level** has turned out to be one of the best in the mine. Completion of lateral drilling shows the ore to have a volume of 9,351 tons per vertical foot, with grade of $14.05 before dilution. The 2,500 ft. level, drilled off some years ago, showed 11,000 tons per vertical foot, but grade was lower at $8.40. On the 2,350 and 2,650 ft. levels, where drilling is still in progress, results are officially stated to be fully up to expectations (which were good).

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More than twenty years ago, Atlas developed "Ottawa" hollow drill steel, a carbon type, which was strong and fatigue resistant, yet capable of heat treating to extreme hardness for cutting ability and wear. It was ideally suited for drilling in which the bit is forged on the end of the drill itself. Later, as heat treating facilities in Canadian mines were improved and modernized to provide more accurate temperature control, Atlas introduced "Vibresist", a high carbon chromium-molybdenum alloy steel, also for conventional drilling use. Used where conditions are right, "Vibresist" has prolonged drill steel life several times.

Came the introduction and development of detachable bit drilling, and Atlas was ready with steels perfectly suited for shanks and bits for use under varying circumstances. Atlas "Ottawa", the old standby, and Atlas "Chippewa" . . . an alloy steel not suitable for conventional drills, but developed specifically for outstanding shank body life, proved ideal at the outset. More recently, another alloy shank steel, Atlas "Nushank", has been developed, to supplement "Chippewa", for certain special requirements. For use in the manufacture of detachable bits themselves, Atlas produced deep hardening and shallow hardening steels in various grades, each grade designed to meet the hardenability requirements of a given bit design.

When Canadian mine operators began to experiment with tungsten carbide tipped drills and carbide tipped detachable bits, they naturally looked to Atlas to provide the hollow drill steels, the shank steels, and the detachable bit steels which would give best results in conjunction with carbide tips. Here again, Atlas "Ottawa", "Vibresist", "Chippewa", "Nushank", and special alloys produced for detachable bit makers proved their superiority.

Whatever developments in drill design and drilling practice the future may bring, the steel that gives best results under any set of conditions will be produced by Atlas at Welland, Ontario—Canada's mining town without a mine.

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QUEBEC

★Oversubscription of the $7 million bonds of **Barvue Mines** adds another record to the already impressive list compiled by this coming Barraute area zinc-silver producer. In less than a year from the date of the first surface discovery, the property is financed to production. At 4,200 tons its initial daily milling rate will be bigger than that of any other Canadian mine in the past 20 years. Start of production is scheduled for the second quarter of 1952.

The operation will be open pit, with enough ore reasonably assured to keep the mill going for at least 13 years.

★**Initial drifting east and west of the shaft on the first level at the Louvicourt twp. property of Obaska Lake Mines indicates that the company is off to a good start in its underground work. The shaft was sunk last spring and levels are being opened at depths of 150 and 300 ft. The structure is complex and work on the second level is just starting to reach the ore zone. But first level results suggest dimensions and grade considerably higher and more uniform than those disclosed by surface drilling.**

★**Tonnage milled by Quemont Mining Corp.,** gold-copper producer in the No-

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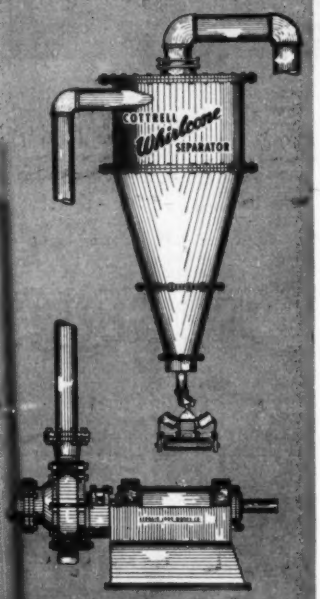

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Quebec *(Continued)*

randa area, has been higher this year: 381,505 tons in the first half versus 370,831 tons in 1950's opening six months. As base metal prices have also been up, Quemont's dollar value of production, when reported, should show a substantial increase.

★An extensive program of prospecting has been done this summer by **Fenimore Iron Mines** on its concession of 200 sq. mi. toward the north end of the Labrador Trough in the Ungava Bay district. Camps were built and 1,500 claims were staked last winter, and complete equipment for camp and field work was flown in from Fort Chimo after being taken up the Labrador coast by chartered steamer. A number of potentially important iron shows have been under investigation by surface stripping and diamond drilling.

NEWFOUNDLAND

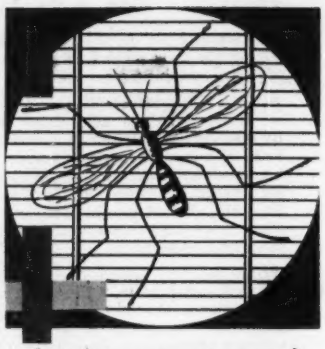
★Large-scale mechanization at the Bell Island mines of **Dominion Wabana Ore** will raise iron ore output to 2.5 million tons next year and to 2.8 million tons by 1953. This will make Wabana the biggest iron producer in Canada for the present; however, both Steep Rock and the Labrador deposits are scheduled to exceed that production rate within a few years.

Wabana ore, too high in phosphorus and silica for most American steel makers, is sold mostly to the parent company, Dominion Steel & Coal, at Sydney, N. S., with smaller percentages finding a market in Britain and Germany. Wabana's operations are unique, for all mining is done beneath the Atlantic Ocean. The deposits on Bell Island itself, in Conception Bay 15 mi. from St. John's, were worked out years ago, and mine openings have since been extended as far as 2½ mi. out under the sea. Total ore reserves are estimated at from 2½ to 10 billion tons, with at least 50% recoverable by present methods.

YUKON

★**Latorma gold mine,** consisting of 31 claims in the Carmac district, has been optioned by Garskie Gold Mines, after being shut down since 1940. The company plans to bring the mine into production. L. F. Gauvreau, after examining the property, has recommended that production be started on a basis of 25 tons daily, with a mill constructed to handle 50 tons. Annual tonnage of about 9,000 tons can be milled during the six summer months, but stockpiling should be carried on through the year. Exploration and development work would be continued under the proposed $432,000 program.

★**Mackeno Mines** is increasing its op-



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erations and advancing about 100 ft. per week in the MacLeod and Sime adits in its Mayo district holdings. A late report said 635 ft. of drifting had been completed in the MacLeod and 831 ft. in the Sime adit. Exploratory work in cleaning up workings has shown grab samples with good lead-silver assays.

★High recovery has been recorded by **Yukon Consolidated Gold Corp.** during the early months of the 1951 season from its dredging operations in the Dawson district. Cleanups before commencement of dredging yielded gold recoveries valued at $15,100 in February and $15,000 in March. Value of production from dredging operations was $239,000 in May and $303,000 in June. With dredge No. 7, previously working on Quartz Creek, idle, the company has seven dredges in operation. Yukon Consolidated had a net profit in 1950 of $879,695, compared with $593,058 in 1949.

IN LATIN AMERICA

CHILE

Issues of Chile copper agreement explained—High prices spur copper output

★For about a month Messrs. W. H. Hoover and Charles R. Cox, presidents of **Anaconda and Kennecott** Copper companies respectively, have been in Chile discussing with the Government **a new modus operandi** with regard to taxation, the quantity of dollars the companies will have to return to Chile and means of increasing copper production. Until now, Chile has pursued a discriminatory policy with regard to the American copper enterprises in the country, Chile, Andes and Braden, by requiring them to get Chilean currency from the Central Bank at the fixed rate of 19.37 pesos per dollar, when the free rate of exchange is 90 pesos to the dollar. Until 1930 rate of exchange was 8 pesos to the dollar. A new rate is to be set.

The American enterprises, on their part, agree to pay as taxes 67.3% of their profits instead of the 50% they now pay; will invest $200 million in the next five years to expand copper production capacity; and will undertake to maintain production of their mines in Chile at the same rate as those of other properties owned by them abroad.

Press reports so far are not clear as to what the new rate of exchange allowed to the companies will be, and whether the $150—$170 million Anaconda is investing in the new Chuqui 60,000-ton sulphide mill and the smelter is considered as part of the $200 million the American companies will have to invest in increasing capa-

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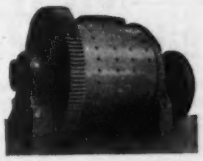

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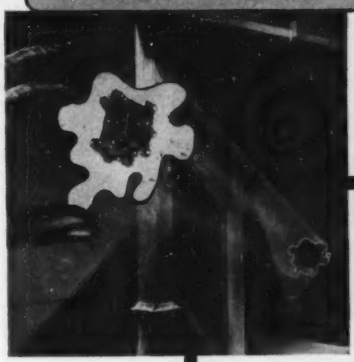

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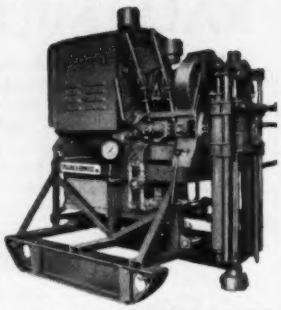

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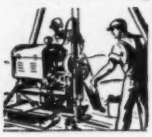

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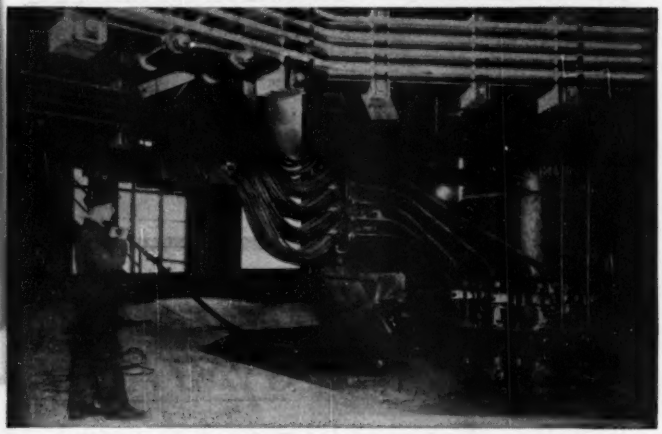

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Chile *(Continued)*

city in the next five years. Neither the Government nor the companies have yet made any official statements.

★**Cía. Minera Punitaqui**, which owns a large flotation and cyanide mill near Ovalle, is now milling about 150 tons a day of 1.8% copper ore obtained from the **dumps of the old Tamaya Camp** which is 43 mi. from the mill. Ore is hauled in diesel trucks. Concentrate grade is 25% copper and 0.55 oz. gold per ton. Punitaqui can mill about 400 tons a day of this dump ore. Tamaya dumps contain about 400,000 tons of 1.8% ore.

★**Antofagasta's province copper mines**, where Chuquicamata is located, have very deep oxide zones. Because of this, when the grade of the ore is too low for shipping it must be leached and the copper in resulting solutions precipitated with scrap iron. As sulphuric acid is scarce, miners are employing $NaHSO_4$ which contains 30% H_2SO_4 as a solvent to leach the ores. This salt is obtained from the Calama dynamite works, Du Pont subsidiary.

★**Cía. Minera Disputada de Las Condes**, a copper enterprise, will increase mill capacity by installing two Symons cone crushers to deliver ore to four 6 x 6-ft. Allis Chalmers mills at minus ⅜ in. instead of 1½ in. Production is expected to increase by about 30%.

★**Caja de Crédito Minero's Salado and Punta del Cobre mills** are now producing greater quantities of copper concentrates because of the much better schedules offered by the Paipote smelter, which will start production in October.

★**Because of better copper prices offered by European buyers**, copper mining is increasing all over the country. If conditions remain as they are, copper output from the small and medium sized mines may reach record figures within a year. Lack of mine and milling supplies, trucks and certain food stuffs in the mining camps is preventing a much faster growth in output of small remote copper mines.

MEXICO

New iron discoveries reported—AIME to meet in Mexico City in October

★Inspired by experiments at Temple, Utah, **to obtain vanadium from asphalt**, Petroleos Mexicanos (Pemex), the official oil company of Mexico, is seeking to extract vanadium and possibly uranium from asphalt, according to the Ministry of National Economy.

★Two promising mineral finds are being checked by the National Institute for the Investigation of Mineral Resources. **One is an iron deposit at Cerro del Cubero, Michoacan.** The Insti-

tute estimates this tract contains 15 million metric tons of iron. Assays are reported to run 67% iron. The deposit, near the Pacific coast, is entirely apart from other Michoacan iron tracts, the Institute emphasized, but it will be included with others in plans of the Government for large-scale development either by the Administration or by Government-sponsored private enterprise.

The other discovery was made by Eduardo Aguila, mining engineer-geologist, in a 30-sq. mi. area near Guanajuato, Guanajuato. The deposits contain manganese antimony, tungsten, tantalite and columbite.

★Prospectors reported the discovery of a promising iron deposit near Acapulco, Guerrero.

★Preparations are being completed by the National Institute for the Investigation of Mineral Resources to hold the first Inter-American Convention of Mineral Resources in Mexico City Oct. 29 to Nov. 4, with the American Institute of Mining and Metallurgical Engineers and the Pan American Institute of Mining Engineers and Geologists. Some 2,000 delegates, mostly from the U. S., Mexico and Canada, are expected. The Mexican Mining Association and the Mexican Mining Chamber are cooperating in plans for the assembly.

IN THE PHILIPPINES

Gold production gains over 1950 figures—Soriano to explore Tambis claims

★Production figures for the first half of 1951 for the five wheel horses of the Philippine gold mining industry, Balatoc, Benguet, Mindanao Mother Lode, Atok Big Wedge and Surigao Consolidated, in the order of their importance, show increases for all the mines except Atok, where the grade of the ore has declined compared to 1950. The improved showing for Surigao Consolidated is particularly noteworthy. Details are presented in the tabulation that follows. Gold value is calculated at the statutory price of $35 per ounce.

Mine	Total Tons Milled Jan.-June, 1951	Total Value of Gold Output	Average Value Per Ton
Balatoc	234,100	$1,685,900	$ 7.20
Benguet	196,900	1,652,500	8.35
Mindanao Mother Lode	60,100	1,047,400	17.50
Atok Big Wedge	82,100	877,700	10.80
Surigao Consolidated	55,900	812,600	14.50
	629,100	$6,076,100	$ 9.65

The total Philippine gold output in the January-June period is more than

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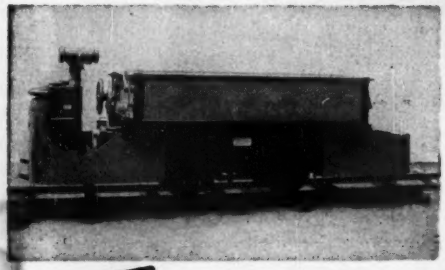

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Philippines *(Continued)*

the 173,600 oz. indicated in the table, as the substantial amount of by-product gold recovered in the copper production from Lepanto Consolidated is not included; nor is the output from the Tambis gold dredge and from the dragline placer in Surigao.

Despite the dubious outlook ahead for the gold mining industry, it is quite likely that production in the second half of 1951 will exceed the first half. Some of the formerly important Marsman mines will be back in production on a limited scale after 10 years of shutdown. The **Itogon mine** in Baguio, which had produced $17,500,000 of gold before the war, will resume production in September on the basis of 10,000 tons per month. The operating plant, which was 90% destroyed during the war, has been completely rebuilt. The **Coco Grove dredging operation** at Paracale will start in August with production from one of the re-built dredges. Much of the rebuilding of the dredge has been under contract with the Pacific Engineering Co. of Manila. It is planned to dredge 2 million cu. yd. a year.

In the Paracale field in south central Luzon the Marsman company has been rebuilding the United Paracale mill and surface plant, now 50% completed. The reconstructed mill will have a capacity of 300 tons per day. The McDonald workings have been partially unwatered. Pumps with a capacity of 4,000 gpm have arrived for the Longos section of the mine and pumping will begin as soon as electrical equipment can be installed. It is planned to retreat the concentrates from the United Paracale mill at the San Mauricio plant. Besides a bullion product, the company expects to recover separate copper, lead, and zinc concentrates of commercial grade.

All of the **San Mauricio mine workings** have been unwatered to the 750 level. Production should begin before the end of the year, with milling at the rate of 350 tons per day. All the rehabilitation work has been made possible by payments received from the War Damage Commission together with loans from the Philippine R.F.C. and from associated companies.

Soriano & Co., operating managers of the **Antamok Goldfields Mining Co.**, has taken an option on gold lode claims of the **Tambis Gold Dredging Co.**, which has operated successfully for many years on the east coast of Mindanao. The Soriano company is in receipt of funds from the War Damage Commission but admitted that ore reserves on the old Antamok property would not justify rehabilitation of this property. Search was made for a mining property that would warrant exploration and possible development, and the Tambis lode claims appeared suitable for the purpose. About 75,000 pesos will be spent on exploration. When the results of the work are known, stockholders will decide whether to finance development to the extent of 1,200,000 pesos as provided in the preliminary agreement.

★In spite of difficulties with the Huks and the constant danger of attack from marauders, work is progressing at the **Acoje chromite property** in Zambales. About 1,600 tons of 45% chromite with a 2½:1 chrome-iron ratio is being produced. A washing plant will be ready by February, 1952. **Consolidated Mines**, which operates the Masinloc chromite deposit in the same territory, has had continued trouble with the Huks. Fear of attack has limited to daylight hours trucking from the mine to the loading pier. A belt conveyor at the pier will be in operation before December.

IN AFRICA

Platinum output to double—Orange Free State gold mill starts production

★**Platinum production** in the Union of South Africa will be doubled, and matte recovered is to be refined locally instead of exported as in the past. Increased production will start early in 1952 and reach full capacity in 1953. Current output is about 123,000 oz. per year, valued at £30 million.

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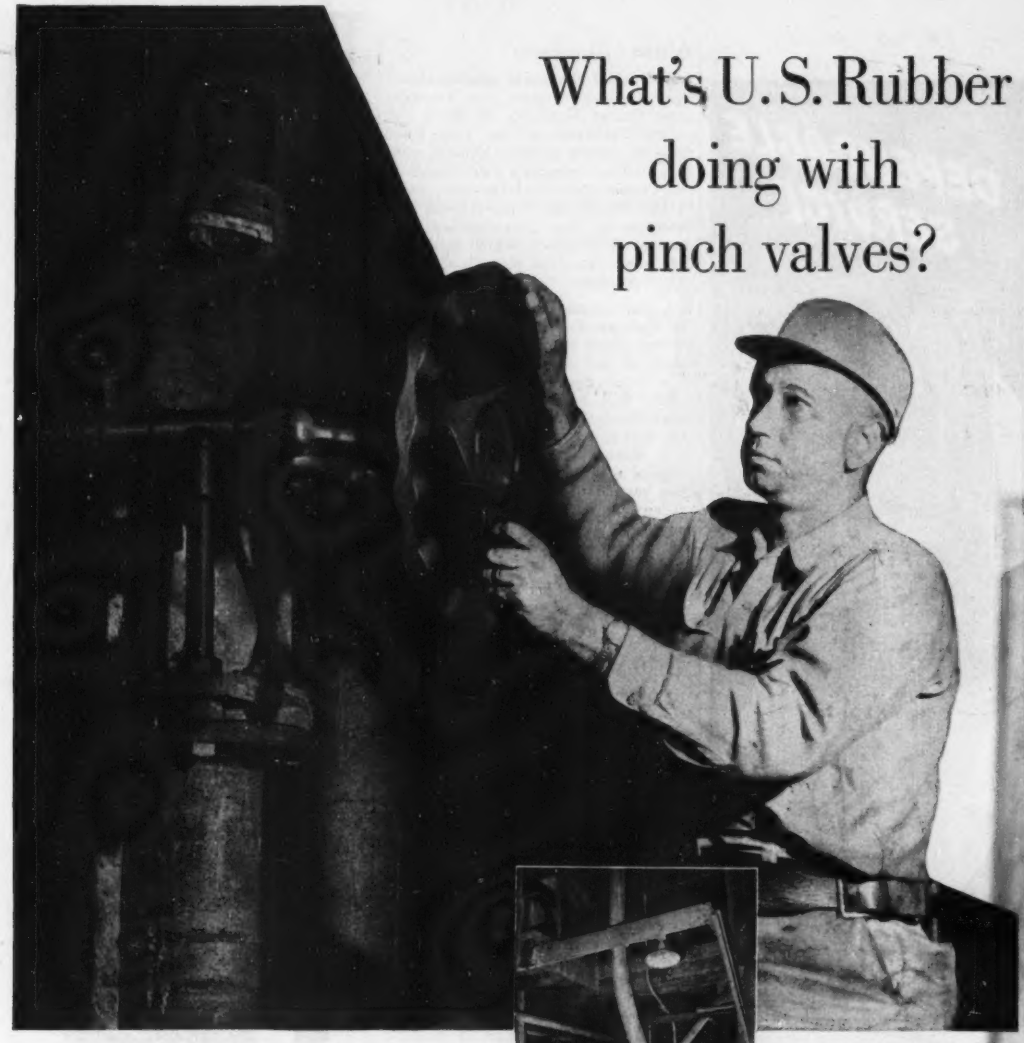

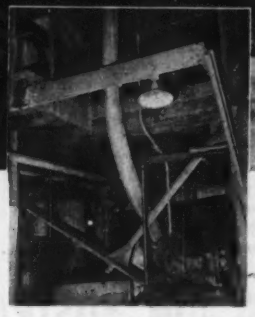

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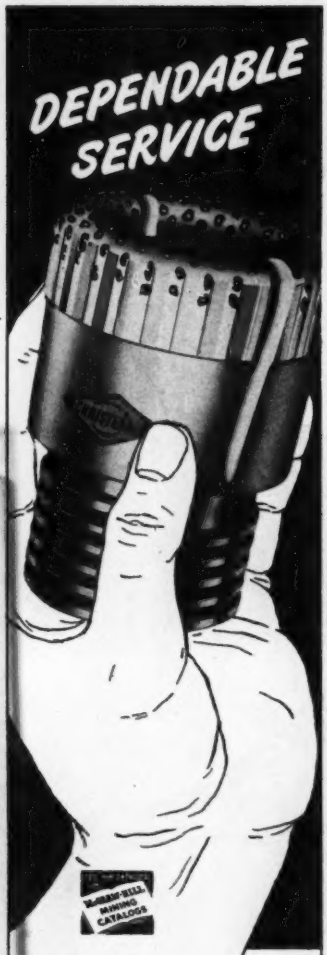

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Africa *(Continued)*

★**Because of the world sulphur shortage,** Rhodesia Broken Hill Development Co. of Northern Rhodesia will extend activities of the Iron Duke mine to supply pyrites, hitherto used only in the company's own works on the Copper Belt, to large-scale users in the Union of South Africa. The company is also investigating production of cadmium which might be obtainable from the zinc plant purification residues.

★**A radical mining development** for the Orange Free State goldfields is taking place at Jeanette G.M.—the latest of the Anglo American mines now being developed. Twin circular shafts will be sunk instead of the established rectangular shafts. It is felt that this type of shaft will compare more than favorably with the original method in respect to ventilation capacity, speed of sinking and strength of shaft. The world's sinking records at Virginia were made possible by new techniques in circular shaft-sinking. It is hoped that reasonable sinking rates will be maintained at Jeanette.

The shafts will be placed about 150 ft. apart—one upcast and the other downcast. The downcast shaft will be concrete-lined throughout. The shafts will be connected at each level to the twin haulages—a system which is proving advantageous in development so far accomplished at Welkom.

★**The first milling operations** in the Free State gold fields were started at St. Helena at the beginning of July. It is expected that the first gold will be produced during October when initial capacity of 50,000 tons per month will be reached. The plant at Welkom is scheduled to start up during this quarter for metallurgical test purposes. Underground development work has been under way for 12 months, and this low-grade rock will be used for mill feed. The main haulage between the two Welkom shafts was scheduled for completion in August. Thereafter underground labor forces will be increased. Under South African law the labor force is limited until a mine has two connected shafts.

IN AUSTRALIA

Even the bushmen are mining tungsten — Rising costs worry gold producers

★**Australian mining circles are uneasy** over a new steep rise in the so-called basic wage, rapid strengthening of inflationary forces, and the Government's intentions to re-introduce anti-inflationary controls. Gold mining companies seeking to offset new increases in wages expect that new

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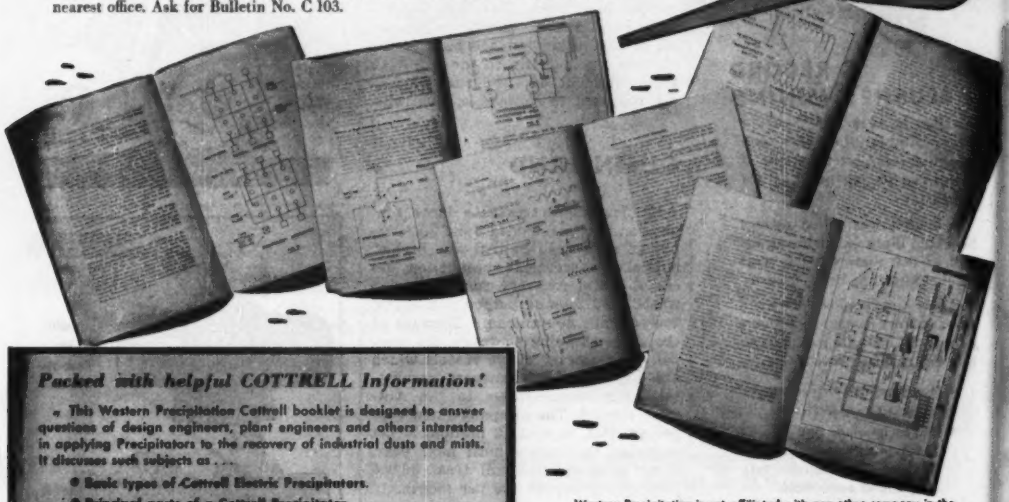

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Attention was called to this Skookum Block only when it was noticed that there was less wear on the wire rope being used.

An extremely wide sheave and throat allows passage of a square knot in 1⅛-in. wire rope, especially designed to prevent wear.

- Manganese steel sheaves,
- Annealed cast steel sides,
- Timken bearings and Skookum patented grease retainers are responsible for 15 years of economical, trouble-free performance.

OTHER MINING STOCKS

Skookum slusher dragline blocks with alloy tool steel swivel crosshead.

T-8

80

Skookum Guide Block. Used in conjunction with slusher blocks. Carries slack.

Specify SKOOKUM when choosing blocks

Refer to folios F1-F4 in the 1950-51 McGraw-Hill Mining Catalog Service.

SKOOKUM CO., INC.

8504 N. Crawford Portland 3, Ore.

Australia *(Continued)*

pressure will be exerted to get Government permission to sell some gold in the free market, following the South African example. However the Government is not expected to sanction this because it plans to borrow some $150 million from the International Monetary Fund.

★In Northern Territory a fantastic rush is beginning to the wolfram fields. Planes, trucks, trains and taxis are bringing hundreds of prospectors to the fields near Hatches Creek, Barrow Creek, Wauchope, Mt. Doreen, and Pine Creek. **Even old aborigines are digging wolfram** out of the ground with yam sticks, filling old tin cans with their treasure, and selling it at high prices.

NEW CALEDONIA

★**Huge reserves of nickel and chrome** are now receiving more attention. Activities in Noumea State are particularly high. France is still buying up all of the nickel but the bulk of the chrome ore is going to the U.S.A. A trial shipment of 7,895 tons of iron ore was sent to Newcastle, Australia.

QUEENSLAND

★**Mt. Isa Mines treated a large tonnage** in the year ended June 30. Output of silver-lead bullion was higher, but zinc concentrate production declined. Total recovery for the period was 33,495 tons of bullion and 35,096 tons of zinc concentrates. Because of the acute shipping shortage, the company has chartered two vessels which are beginning to transport accumulated zinc concentrates to the Antwerp market. The company's new copper smelter, to cost £2 million, is not expected to operate until next year. When completed it will treat 36,000 tons of 4% copper ore per month.

FAR EASTERN TIN MINING

★Six tin mining companies controlled from Melbourne have now **received war damage compensation** from the Tai Government. These include Tongkah Compound No. 3, Compound No. 4, Tinsongkhla, Rangang Tin, Peninsula, and Satupulo. Payments have also been made to Takuapa Valley Tin Dredging and Katu Tin Dredging.

Dredging companies still think that lower prices will enable them to work at a profit, although some of the companies may close down because of the risk of bandit attacks. First to close would be the Chinese high-cost producers.

Scattered Jobs?
Get Action Fast...

See Pages 22, 23

Recognized Universally as the ULTIMATE in Valves and Couplings

KNOX MANUFACTURING CO.

223 W. Clinton Ave. Oaklyn, N. J

SINCE 1911 PRODUCERS OF

KNOX Valves - Couplings - Hitches - Clamps - Handles

O-B Type BH-4 Motor Starter controls 75-hp motor with direct drive to pump of 350 gpm capacity. Inset illustration shows clear space surrounding each starter component for easy maintenance.

O-B STARTER SELECTED FOR MAIN PUMP PROTECTION

Installation At Old Ben Uses BH-4 Starter For Continuous Protection

Failure to keep water moving out of the mine can be a serious matter. That's why the Old Ben Coal Corporation selected the O-B Type BH-4 Motor Starter for complete protection of the motor driving the main pump at Shaft C of No. 9 Mine. It provides positive control and complete protection from the abuse of short circuits and overloading; gives them assurance that this pump motor will be on duty at all times to prevent the danger of flooding.

You can get the same dependable motor starter performance for your motor-driven equipment with O-B Starters. A complete line of new motor starters, covering applications ranging from 5 to 75 horsepower on pumps, conveyors, compressors, belt conveyors, hoists and similar equipment is available. Write to Ohio Brass Company for descriptive booklets on this new line.

Ohio Brass

MANSFIELD OHIO, U.S.A.

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

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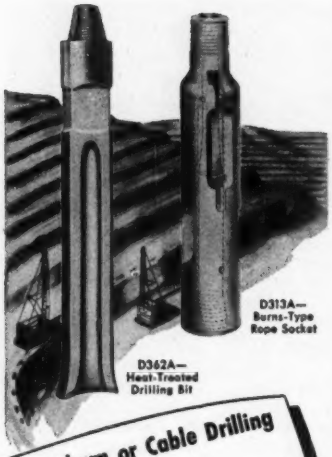

For Churn or Cable Drilling
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• PROSPECT HOLES
• SAMPLING
SAFE • EFFICIENT • ECONOMICAL

Spang Churn or Cable Tools are top performers in their fields for drilling test holes when prospecting or sampling . . . drilling blast holes for fragmentation of minerals or overburden . . . drilling and reaming escape, dewatering and ventilating holes . . . and drilling wells for other purposes. Fifty years' experience serving oil, water-well, mining and quarrying operations assures their value.

D606—Reamer-Type
Pilot Bit

LARGE BITS
for pilot hole drilling and stope enlargement reaming of dewatering, ventilation and escape holes.

D370F—Prefabricated
Star Bit

Washington Impact *(Continued)*

copper stockpile, judging by guarded admissions from key mobilization figures. In addition to suspending shipments to the stockpile, it is believed that some stockpiled copper has been doled out to industry. The President has authorized release of 25,000 tons, largely because of the loss of production engendered by the Garfield smelter dispute.

Defense Production Act

If the new Defense Materials Procurement Administration wants to use subsidies as a means of stimulating production, it will find broad power to do so in the new Defense Production Act. The Act also continues the powers under which expansion has been promoted to date: exploration assistance, purchase agreements, quick tax amortization, and loans.

The new subsidy provision empowers the President to purchase at above-ceiling prices or to subsidize in any other manner he chooses. If purchases are made above ceiling prices, the Administration can resell the supplies at a loss, but not below market or ceiling prices.

The Administration can pay minerals subsidies if it thinks price ceilings are going to decrease supplies of needed materials, and in those cases in which a temporary increase in the cost of transportation seems to be impairing maximum production or delivery. However, above-market prices cannot be paid or losses on resale incurred "unless it is determined that supply of the materials could not be effectively increased at lower prices or on terms more favorable to the Government, or that such purchases are necessary to assure the availability to the United States of overseas supplies."

More than mere purchase is involved. The Government can transport, store, and have processed or refined any materials bought under the subsidy provision.

The ambiguity of the law in regard to foreign activities has not been corrected. Quite clearly the authority to purchase extends to materials of foreign origin, but the general provision that the Act applies to the U. S. and possessions has not been modified. Thus any special powers to make loans or risk-money advances against production apparently do not apply to the foreign field except under pre-existing law, such as acts affecting ECA, the Export-Import Bank, and Point IV activities.

Priorities Assistance

Mine operators can write their own tickets for maintenance, repairs and operating supplies, up to $40,000 worth a year, under NPA's new order M-78. In general, it covers the same area that WPB's P-56 covered in World War II. M-78 does not cover solid fuels, petroleum, uranium, or natural gas production.

The big difference between M-78 and the rules laid down for other industries is that mines can acquire capital equipment costing up to $2,000 per quarter as part of the MRO procedure. The limit for other industries is $750 per quarter.

The $2,000 figure for mining was set to take in such equipment as rock drills. Even though carried as capital equipment on the books, they may be bought as operating supplies under M-78.

Up to $10,000 per quarter, a producer of metals or non-metallic minerals can buy MRO supplies without regard to a quota. He simply uses the allotment symbol "H-6" for whatever he needs of the controlled materials (steel, copper, and aluminum products), and the symbol "DO-H-6" for non-controlled materials and capital additions.

Above $10,000 per quarter the procedure is more complicated. He must go to a quota system, based on 120% of his actual expenditures for MRO items in a base period. The most common base period is the calendar year 1950, though a fiscal-year base may also be used if accounts are kept on that basis.

Over the $10,000 mark, a producer must tell DMA what his quota is and what base period he selects. He must do this within 30 days after using the "H-6" symbol for the first time. He must get special permission to go over the 120% limitation.

For capital goods costing more than $2,000, operators must apply to Defense Minerals Administration, Department of the Interior, Washington 25, D C. M-78 does not cover construction projects; special permission for these must be requested through DMA.

NEW BOOKS

Dynamic Motion and Time Study. By James J. Gillespie, management consultant. The author analyses methods of increasing efficiency without evoking worker antagonism. The workman is not considered as a precision machine to be speeded up on a strictly mathematical basis. Instead the worker's psychological reactions, his surroundings, and his response to the group of which he is a member are all regarded as important factors in influencing efficiency. Although the book is written for manufacturing plant operations, mine managers will find many basic concepts in the text which will prove illuminating and helpful. Published by Chemical Publishing Co., 26 Court St., Brooklyn, N.Y. Pp. 140. Price $3.75.

Guide to Geologic Literature. By Richard M. Pearl, Colorado College, Colorado Springs, Colo. First book published to serve as a guide to the complex world literature on geology, its subdivision, and related fields. All published literature from earliest

dates up to the present is covered by appropriate references to lists, indexes, and bibliographies. Published by McGraw-Hill Book Co., Inc., 330 West 42 St., New York, N.Y. Pp. 239. Price $3.75.

Mining, Processing, and Uses of Indian Mica. By Chand Mull Rajgarhia, mica producer, manufacturer, and exporter. Chapters in this text cover: Mica occurrences, particularly in India; geologic considerations of pegmatites; characteristics of mica; mica prospecting and leases; mica mining; processing of mica; standardization of mica qualities; marketing of mica; and uses of mica. [Editors Note: India supplies 80% of the world's mica requirements.] Published by McGraw-Hill Book Co., Inc., 330 West 42 St., New York 18, N.Y. Pp. 388. Price $8.

Stratigraphy and Sedimentation. By W. C. Krumbein and L. L. Sloss, Department of Geology, Northwestern University. An interesting and concise textbook covering the following subjects: the stratigraphic column; stratigraphic procedures; properties of sedimentary rocks; classification and description of sedimentary rocks; sedimentary processes; sedimentary environments; stratigraphic paleontology; sedimentary facies; principles of correlation; sedimentary tectonics; tectonic framework of sedimentation; stratigraphic maps; and paleography. The writers are generous in attributing source material to geologists who pioneered in the field of stratigraphy, and have pushed forward the frontiers of this subject themselves. However, for the sake of mining men who wish to assimilate a little practical geology along with other subjects, it would have been refreshing to see a break away from such cumbersome terminology as "orthogeosynclines (further subdivided into eugeosynclines and miogeosynclines) and parageosynclines (further subdivided into exogeosynclines, autogeosynclines, and zeugogeosynclines)." Published by W. H. Freeman and Co., San Francisco, Calif. Pp. 497.

The Chemical Determination of Thorium in Its Ores. By John C. Ingles, Department of Mines and Technical Surveys, Mines Branch, Ottawa, Canada, Pp. 26.

Optical Crystallography. Second Edition. By Ernest E. Wahlstrom, Department of Geology and Mineralogy, University of Colorado. Completely revised second edition has been expanded by about 50 pages. Many illustrations were redrawn in three dimensions to add clarity. Emphasis throughout is on the immersion method of determining optical properties of crystals and fragments, because this method is most widely used. Construction and operation of the polarizing microscope are fully explained. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y. Pp. 247. Price $4.50.

Prefabrication of Houses. By Burnham Kelly. A study by the Albert Farwell Bemis Foundation of the prefabrication industry in the U.S.A. Mining companies undertaking housing projects will find this book of interest. Topics covered include design, production, marketing, and cost to consumer of prefabricated houses. In 1948 prefabrication plants were operating in Colorado, Oregon, Washington, California, Arizona, and virtually all states in the eastern half of the U.S. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y. Pp. 466. Price $7.50.

Northampton Sand Ironstone Stratigraphy, Structure and Reserves. By S. E. Hollingsworth and J. H. Taylor. A scholarly and thorough study of the Northampton deposits where proved, probable, and possible ore reserves total more than 1 billion tons. Iron content of workable ore ranges from 28 to 25%. The field yielded 113,732,300 tons of ore from 1918 to 1943. Published by His Majesty's Stationery Office, 429 Oxford St., London, W. 1. Pp. 211 plus maps. Price 17s. 6d. net.

Mining Directory of Minnesota, 1951. By Henry H. Wade. Contains maps of the Minnesota ranges with list of reserve properties and key to maps; also tables of iron ore reserves in Michigan, Minnesota and Wisconsin; shipments of Lake Superior iron ore dating back to 1854; average analysis of ore; classification of iron ore shipments; list of beneficiation plants; shipments of concentrated iron ore; base prices of iron ore; rail and lake freight rates for ore; assessed valuation of iron ore in Minnesota; production costs; and other important data. Published by the University of Minnesota, Minneapolis, Minn. Pp. 259. Price $1.

Structural and Mechanical Properties of Metals. By Bruce Chalmers, Professor of Physical Metallurgy, University of Toronto. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Pp. 132. Price $3.50

Grubengasanalyse im Kohlenbergbau. By Dr. R. Kattwinkel. An 80-page booklet describing and illustrating methods of analyzing gases encountered in coal mining. Published by Walter de Gruyter & Co., Berlin W. 35, Genthiner Strasse 13, Germany. Price, Ganzleinen DM 8,40.

A Geological Reconnaissance of the Country Between Embu and Meru. By J. J. Schoeman, B.Sc. Engineer and Geologist, Geological Survey of Kenya. Pp. 57 plus map. For Sale by Government Printer, Nairobi, Kenya. Price 12s.

Canadian Trade Index, 1951. Lists over 10,000 manufacturing firms in Canada. Published by the Canadian Manufacturers' Association, Inc. 67 Yonge St., Toronto 1, Ontario. Pp. 1,106. Price $7.50

WEIGH WITHOUT STOPPING

WHILE YOU CONVEY

Yes, weigh and record with the —MERRICK

WEIGHTOMETER

The Merrick Weightometer provides a continuous, automatic, accurate weight record at any designated point in the mill, while material is in motion on conveyor. It weighs without interrupting conveyor service.

Applicable to any size belt conveyor, horizontal or inclined. An accurate and dependable means of keeping constant check on production.

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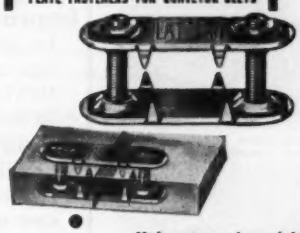
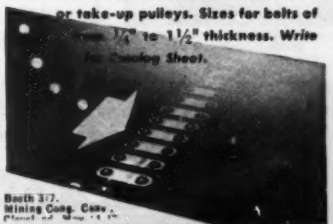
PLATEGRIP

PLATE FASTENERS FOR CONVEYOR BELTS



Make strong dust-tight, water-tight joints in belts of any width. Special design spreads tension uniformly across belt, allow natural troughing of belt and assures smooth operation over flat, crowned or take-up pulleys. Sizes for belts of [illegible] ¼" to 1½" thickness. Write for Catalog Sheet.



Booth 317, Mining Congress Conv.

ARMSTRONG BRAY & CO.

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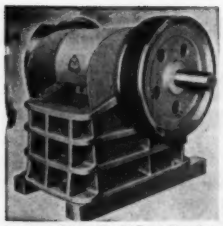
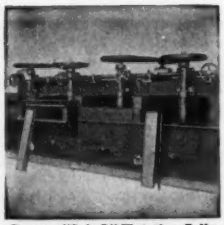


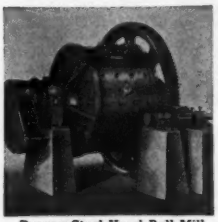
Denver Force Feed Jaw Crusher

Denver Mineral Jig

Denver Cross-Flow Classifier

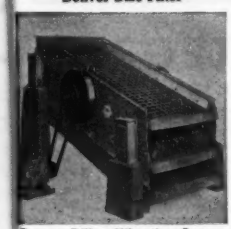


Denver "Sub-A" Flotation Cells



Denver Steel Head Ball Mill

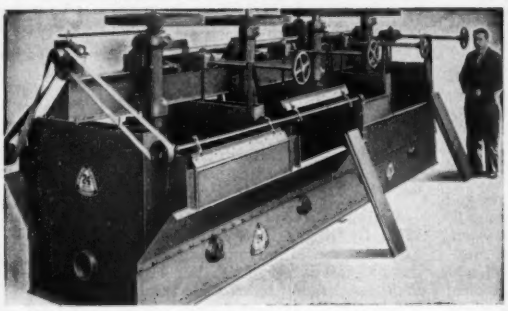
Denver Disc Filter



Denver-Dillon Vibrating Screen, Floor Mounted Type Shown

Continuous tests can be conducted at low cost.

Denver "Sub-A" Flotation
...Standard The World Over



Adjustable Spitzkasten ... Latest design permits overflow of froth at high or low levels with the possibility of roughing with a shallower tank but cleaning with the more efficient deeper cell ... all in the same machine.

Improved Aeration ... Air and/or gas may be admitted at two points. Multi-bladed impellers are available for super-aeration-agitation. Bowl type diffuser liners improve metallurgy in some cases.

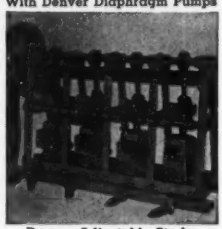
Flexible Tank Structure ... Straight sides or spitzkasten ... single overflow or double ... cell to cell tank division or open flow ... are easy to make changes on most sizes.

No Major Change, but Constant Improvement ... Latest design improvements can be adapted to the oldest Denver "Sub-A." Denver machines don't go out of date. Get details in Denver "Sub-A" Flotation Bulletin No. F10-B50.

Send for your free copy if you do not have one.

Denver Agitator and Conditioner

Denver Low-Head Thickener With Denver Diaphragm Pumps



Denver Adjustable Stroke Diaphragm Pump

Denver Vertical Centrifugal Sand Pump

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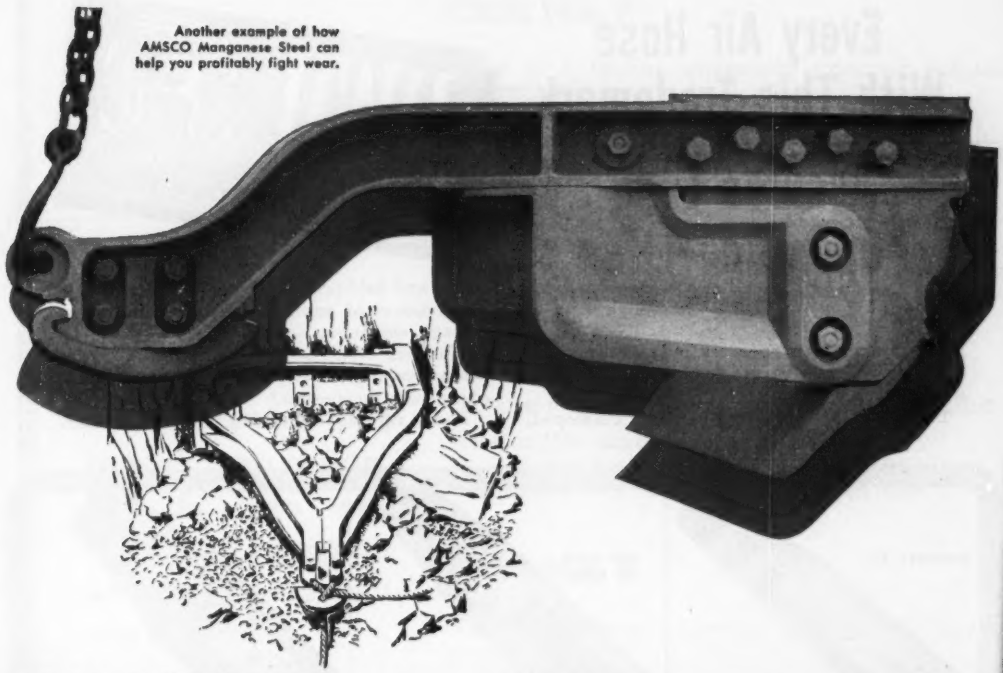


This SCRAPER cut maintenance costs 20%!

How AMSCO Manganese Steel proved tougher than a tough mining problem

One of the toughest mining operations you'll find anywhere—tough from the standpoint of how it punishes equipment—is scraping heavy, corrosive pyrite ore. For example, a California mine has a deposit of 98% pure pyrite—with a specific gravity of 4.8. Impacts and abrasion caused by this ore were making short work of the scrapers previously used . . . on the average they needed major repairs over 4 times per year.

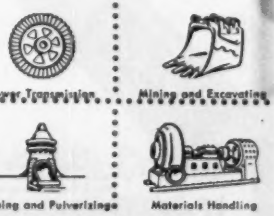
Several years ago two scrapers of the type shown above, which are sold exclusively by Joy Manufacturing Co., were put in service. They were made entirely of AMSCO Manganese Steel, and since then they've mined *over 220,000 tons of pyrite ore — and they're still in excellent condition!* These scrapers are repaired only once a year; simple repairs involving relipping and hardfacing of wearing surfaces.

Obviously, not all mining or excavating operations are as equipment-punishing as this one . . . *but the moral is clear* . . .

WHEREVER YOU MEET A PROBLEM OF WEAR CAUSED BY IMPACT AND/OR ABRASION . . .

. . . find out about longer-lasting, dollar-saving Manganese Steel made by AMSCO . . . world's largest producer of Manganese Steel castings for all industry.

AMSCO controls impact and abrasive wear in 5 basic industrial operations:



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Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. In Canada: Joliette Steel Division, Joliette, Que. Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.

Every Air Hose With This Trademark

Assures Long Operating Life

Air hose economy is not measured in feet per dollar. The only true yardstick of air hose value is *service hours.*

Because every BWH hose has been developed, tested and field-proven to give the best possible combination of strength, safety, flexibility and damage resistance . . . *you get maximum service life.*

Whatever brand of hose you are now buying, you are paying for BWH benefits — so why not start getting them — *now?*

Today, contact your nearby BWH Distributor.

CONCORD AIR

An extra quality, exceptionally rugged hose for toughest use on air drill and pneumatic service in mines, quarries and construction jobs. Non-porous tube resists heat and oil. High tensile cotton yarn braid reinforce carcass. Tough grey cover resists cutting, gouging, abrasion. Made in ½" 2-braid and ¾" 2-braid sizes. 200 to 300 lbs. working pressure. Maximum length 50'.

BAY STATE AIR DRILL

For heavy construction work in mines, quarries, tunnels and wherever large size hose is required for long service. Smooth black tube resists heat and oil. Carcass of strong, rubber-impregnated multiple ply woven duck. Rugged, heavy-gauge red rubber cover resists severe weather extremes, cutting, abrasion. 9 sizes stocked from ½" to 4". Working pressures from 175 to 225 lbs. Maximum length 50'.

AUROCHS AIR

For portable air compressors, jackhammers, rugged industrial and construction work. Smooth, black, non-porous tube resists heat and oil. Carcass multiple ply, rubber-impregnated, rugged woven fabric. Tough black cover resists weather and abrasion. Stocked sizes: ½", ¾", 1". 200 lbs. working pressure. Maximum length 50'.

VIM AIR

For general industrial use, on compressors and pneumatic tools. Black tube resists oil and heat. Husky cotton yarn braids. Smooth, red cover resists weather, abrasion. 8 sizes stocked, ¼" 2-braid to 1" 3-braid. Working pressures 150 to 225 lbs. Maximum length 500'.

BULL DOG VARI-PURPOSE AIR

For a variety of jobs including handling of air, water, oil, gasoline, kerosene (not for paints, lacquers, lacquer-solvents). Black, synthetic tube resists oil and heat. Carcass is braided rayon cord, high strength, super flexible. Smooth, brown, tough synthetic cover resists oil, abrasion, sunlight. 11 sizes stocked from 3/16" one-braid to 1" 2-braid. Working pressures: 200 to 300 lbs. Maximum length approximately 500'.

BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all Principal Cities

PLANT: CAMBRIDGE, MASS.

P. O. BOX 1071, BOSTON 3, MASS., U. S. A.

Performance pays . . .

Mill operators are judged by results. For the man who must be shown, here are some more actual test figures.

Case No. 7

Tests at a mining operation grinding sulphide copper ore.

Service: Marcy 6′ × 4½′ ball mills grinding a high sulphide ore from minus ¾″ to minus 14 mesh. Balls charged were 5″ dia.

Comparison: For many years the company used austenitic manganese steel liners in its mills. Then a change was made to high carbon chromium-molybdenum steel liners, normalized and tempered to 360 Brinell.

Liner type: Shell (barrel) liners, wave type.

Results:	Tonnage ground
Austenitic manganese steel (average)	75,000
Cr-Mo steel (average)	84,000

Case No. 8

Tests at a mining operation grinding gold-bearing quartz ore.

Service: Marcy 6′ × 7′ overflow type mill grinding ¾″ feed.

Comparison: One set of manganese steel liners was run till worn out, and followed by one set of high carbon chromium-molybdenum steel liners run under similar conditions.

Liner type: Shell (barrel) liners, wave type.

Results:	Life—Days	Tonnage Ground
Manganese steel liners	148	48,932
Cr-Mo steel liners	212	74,794

The chrome-molybdenum steel liners showed an increased tonnage ground of 53%.

Write for 32 pp reprint of an informative paper published by the Amer. Inst. of Mining and Metallurgical Engrs., giving results of wear tests on grinding ball materials—FREE!

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Please send your FREE Reprint on "Wear Tests"

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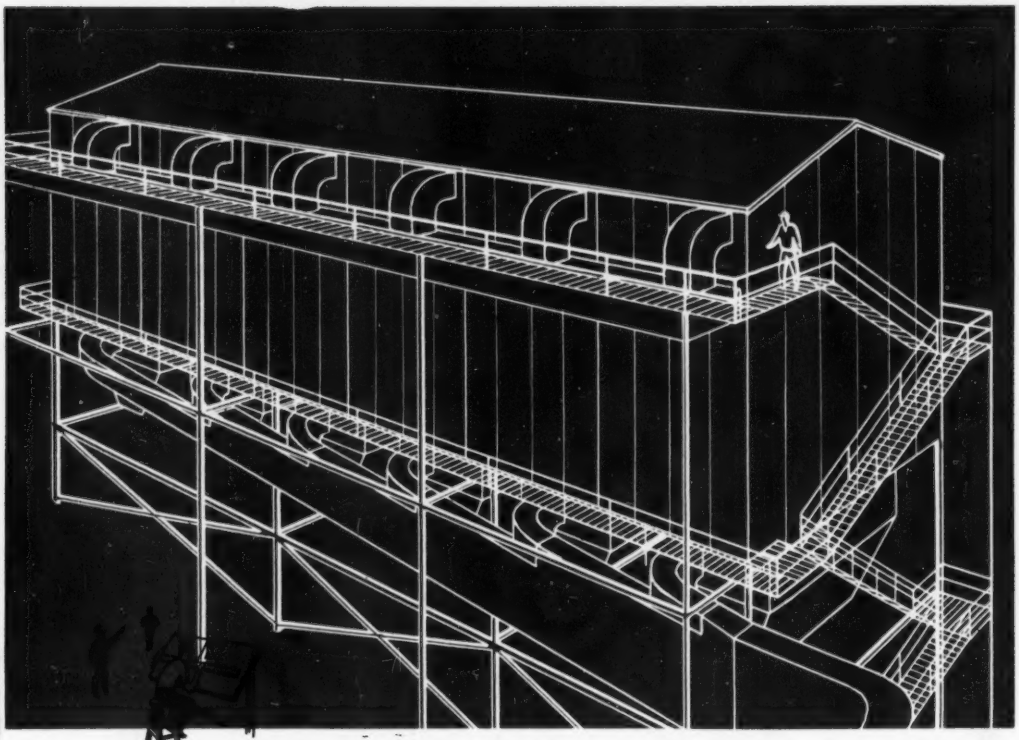


DUSTUBE® . . . custom designed for the mining and metallurgical industry

Dustube Collectors are individually designed for the rigorous dust and fume applications of the mining and metallurgical industry. They have the inherent capacity for continuous, severe service at high filtration efficiency, with a minimum of down time for maintenance. Uniform recoveries approaching 100% are commonplace. Hot and/or corrosive gases are efficiently handled through the use of synthetic filtration fabrics. Automatic units can be designed to permit interior inspection and maintenance of the Dustube without shutting down.

Dustubes can be custom designed to readily fit existing or new plant buildings, flue lines and ground contours. Various arrangements of hoppers and hopper discharge mechanisms are available—including steep-sloped pyramid hoppers with rotary, double-dribble or slide gate valves; trough type hoppers with screw conveyors; or flat-bottom hoppers with built-in scraper conveyors.

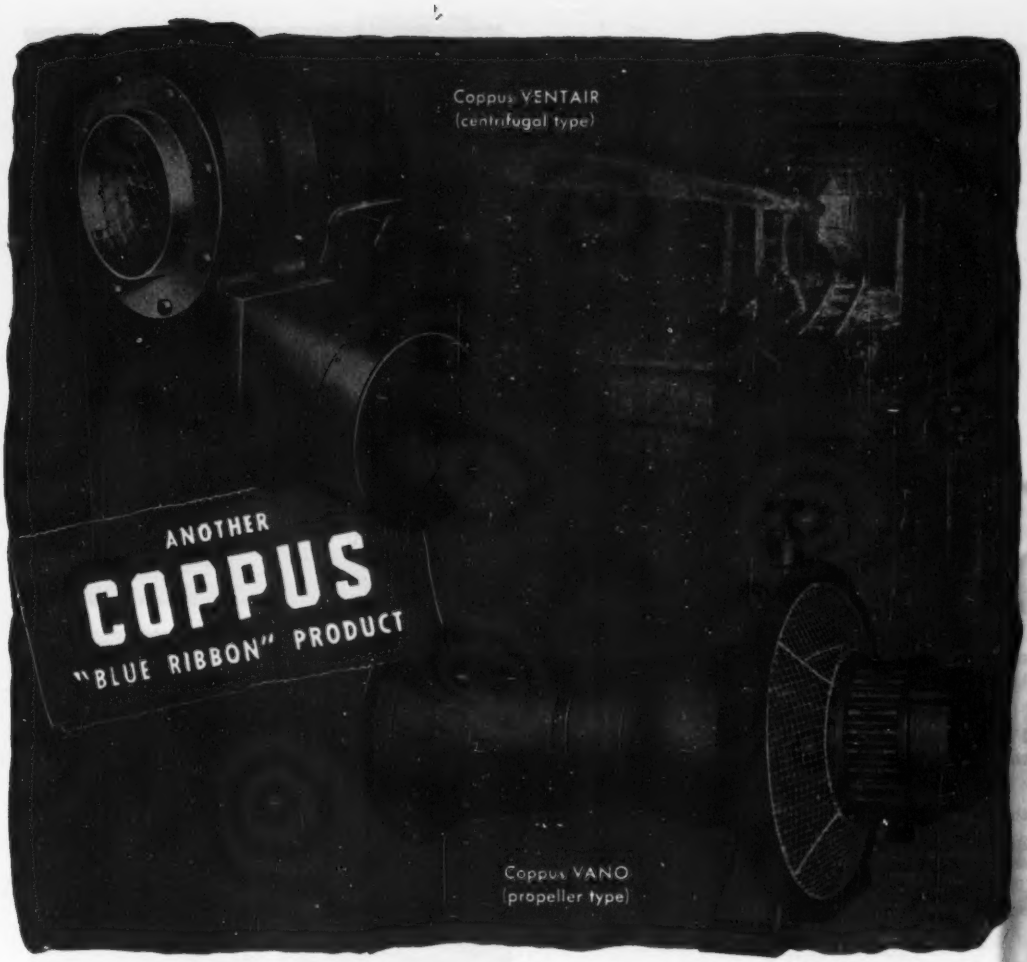
All collected fume or dust is automatically conveyed to one central point, thus eliminating expensive hand labor in handling valuable by-products. Collected materials may be reprocessed without dewatering, filtering or drying.

Our engineers are at your service to assist you in your filtration problems. It will pay you to investigate the many advantages of Dustube Collectors. *Write for complete information today.*

TYPICAL APPLICATIONS

Lead blast furnace gases
Zinc fuming retorts and sinter fumes
Electric melting furnace fumes
Reverberatory lead furnace fumes
Dwight-Lloyd sinter fumes
Filtration of furnace gases

dustube
COLLECTORS



Two Blowers . . . One Purpose: 30 to 100% More Air

Why two totally different blower types? Because the requirements of mine ventilation fall into two entirely different categories.

For high pressures, long pipe lines, use the Coppus VENTAIR (centrifugal type). For medium pressures, shorter pipe lines, the Coppus VANO (propeller type) is best. One or the other will give you more air per given power consumption than other blowers — from 30% to 100% more. Can be used as blowers or exhausters, capacities up to 90,000 CFM, with compressed air or electric motor drive.

Only Coppus makes both types. And, for quick recognition, each wears the famous "Blue Ribbon," distinguishing mark of top-quality engineering, materials and performance. This blue band is your guarantee of better mine ventilation . . . Look for it.

Representatives listed in MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corporation, 282 Park Ave., Worcester 2, Mass.

COPPUS ENGINEERING CORPORATION
289 Park Avenue, Worcester 2, Mass.

Please send: Bulletin 130.

Name.....

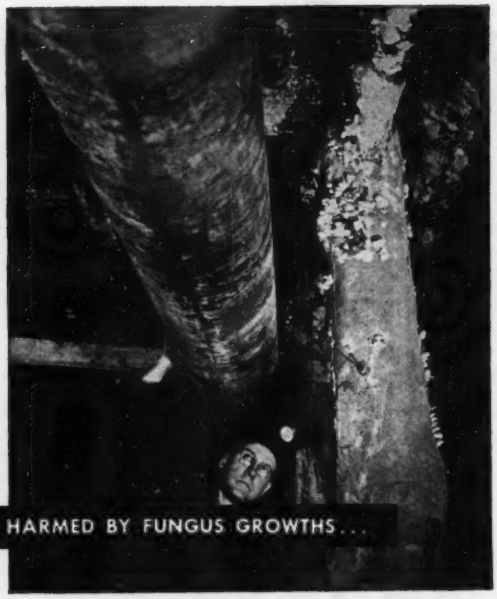
Company.....

Address.....

Depend on DU PONT VENTUBE

TRADE-MARK

SYNTHETIC RUBBERIZED FABRIC FLEXIBLE VENTILATING DUCT



NOT HARMED BY FUNGUS GROWTHS...

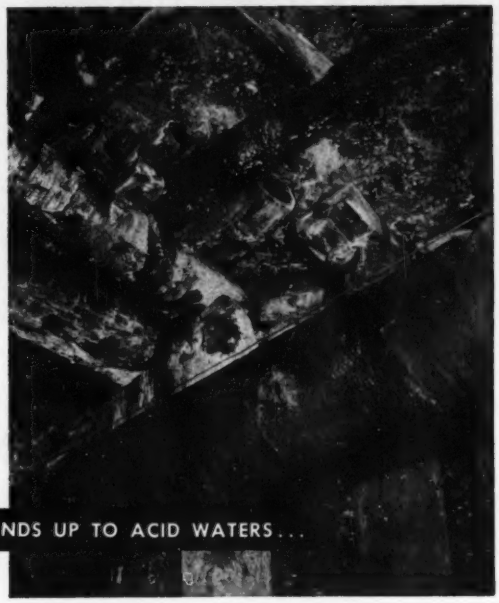
Among the many advantages of Du Pont "Ventube" for auxiliary ventilation are long life and trouble-free operation, which keep costs down and production up.

"Ventube" is triple-treated against fungus growths. First, the fabric is treated, then the coating, and finally the thread used to sew the tubing together is treated.

"Ventube" also gives maximum protection against the corrosive effects of acid mine waters (and alkali waters, too). Even if the tubing should be damaged as a result of blasting, "Ventube" is easy to repair. The bad spot in the tubing can be patched or cut out and a new section coupled into place.

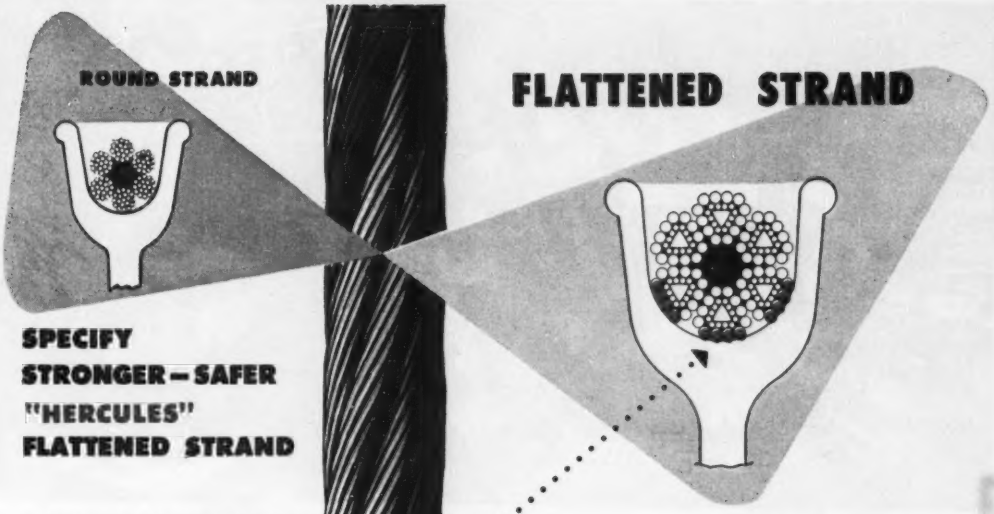
You can *depend* on "Ventube" (attached to a blower fan) to do a good job for you . . . bringing fresh, cool air to men at the face . . . reducing down-time after blasting . . . speeding your production. Lightweight and long-lasting. Easy to install, to move, to store. Low in both original and upkeep cost.

For further details, consult Du Pont technical service, Fabrics Div., E. I. du Pont de Nemours & Co. (Inc.), Empire State Bldg., New York 1, N. Y.



STANDS UP TO ACID WATERS...

DU PONT "VENTUBE"
DU PONT
FOR LOWER PRODUCTION COSTS THROUGH BETTER VENTILATION
BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY



SPECIFY STRONGER—SAFER "HERCULES" FLATTENED STRAND

- 10% EXTRA STRENGTH
- LARGER METALLIC AREA
- SMOOTH RUNNING
- SMOOTH WEARING
- EASIER TO RIG
- EXTRA SAFETY
- EXTRA ECONOMY
- RED-STRAND QUALITY

SPREADS THE LOAD FOUR WAYS

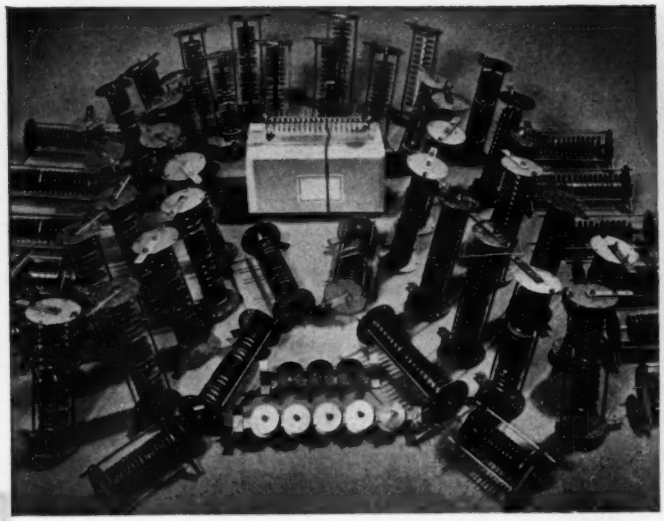
"Hercules" Flattened Strand design spreads wear over *four* wires—not just one as in round strand. This compact outer surface greatly reduces *wear* in grooves of drums, sheaves and idlers. Tends to keep them smooth.

The triangular cross-section of the strands permits a smaller core, larger contact area between strands, and greater resistance to crushing. A smaller size Flattened Strand rope can usually be used for the same strength and safety requirements as round strand. Makes for *easier* rigging in tough spots.

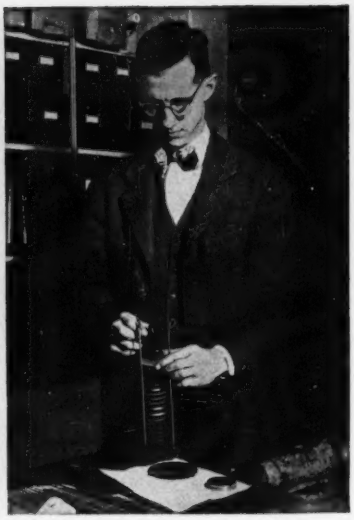
Take advantage of the greater strength and economy of "Hercules" Flattened Strand Wire Rope.

LESCHEN WIRE ROPE

Consult our Engineering Department for specific recommendations. **A. LESCHEN & SONS ROPE CO., 5909 Kennerly Ave., St. Louis 12, Missouri.** Distributors in all principal cities.



SPOOL-TYPE SPECIMEN HOLDERS permit testing several materials under service conditions without risk of mechanical damage. Specimens make no contact with each other or with plant equipment . . . thus, galvanic effects are prevented.



ASSEMBLING A CORROSION TEST SPOOL. Specimens are machined to specified dimensions, and expose exactly 0.5 sq. dm. when mounted for test.

Help for solving your INDUSTRIAL CORROSION PROBLEMS . . .

Available for solving your specific problem is a vast amount of information on industrial corrosion.

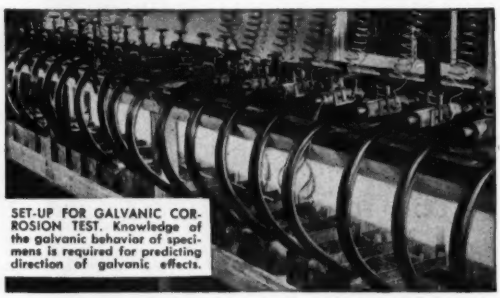
Acquired and catalogued by The International Nickel Company's Corrosion Engineering Section, this fund of data is constantly being increased.

Valuable information is obtained in various ways . . . for instance, by cooperative field tests in which specimens are exposed to actual plant operating conditions. Also, by fundamental investigations in the laboratory and by tests that duplicate, so far as practical, existing or expected conditions where plant tests are impractical.

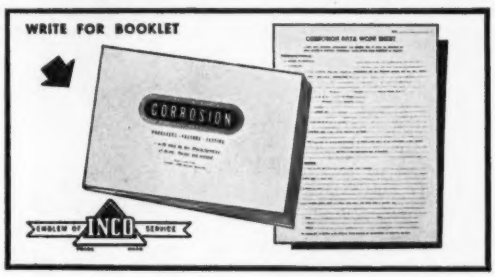
A great deal of important data comes from INCO's large scale marine testing stations at Kure Beach and Harbor Island, and from stations having industrial and rural atmospheres. In addition, technical literature, reports, and manufacturer bulletins contribute useful information.

Our files contain data from more than 2,000 plant tests on some 40,000 metal and alloy specimens. All information is tabulated on standard forms, and a punch card key sort system facilitates finding specific data.

We freely provide the Corrosion Data Work Sheet, illustrated, for presenting your specific problems.



SET-UP FOR GALVANIC CORROSION TEST. Knowledge of the galvanic behavior of specimens is required for predicting direction of galvanic effects.



Whenever you need assistance in solving a corrosion problem, our Corrosion Engineering Section will gladly cooperate with you. A free copy of the new booklet entitled "Corrosion" may help you defeat corrosive attacks . . . write for it now.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

triple play for profit

with P&H ELECTRIC SHOVELS

All three of these P&H Electric Shovels are at work for J. Robert Bazely at Pottsville, Pa. There are three sizes at work here — 4, 5 and 6 cu. yds., all delivering steadily at rock bottom costs.

P&H leads the field in Electric Shovel Developments.

It's the same pattern wherever these new P&H Electric Shovels go to work: The first machine sells the second — the third — and more.

The reasons are plain and simple — *better performance — bigger production — lower tonnage cost.*

Reasons behind the reasons are such advantages as P&H Magnetorque* which powers hoisting motions electro-magnetically — smoother, faster, more dependably . . . rugged all-welded construction with more strength to withstand shock loads . . . independent propel for quicker move-ups . . . stepless control which eliminates all contactor troubles . . . filtered air cab ventilation for less electrical down time.

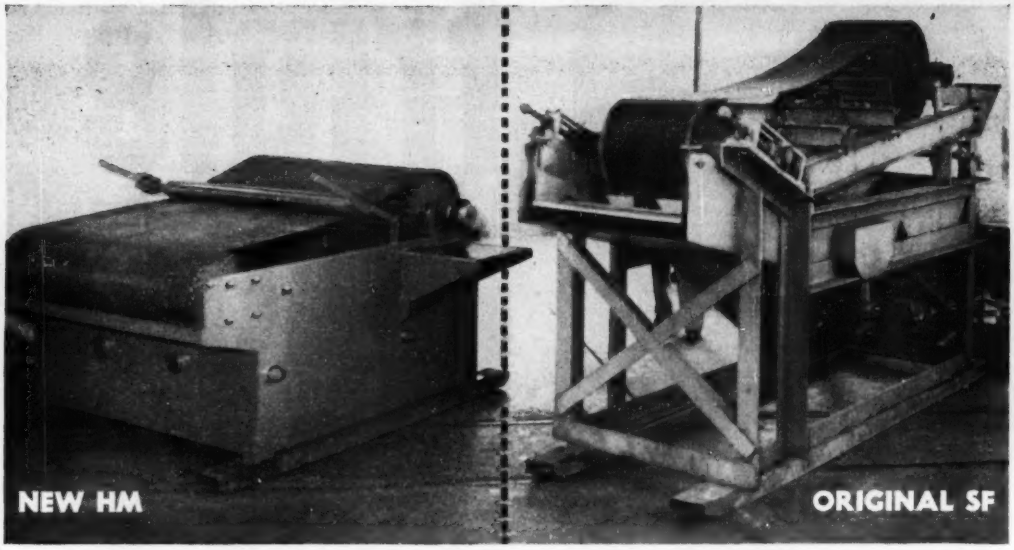
The cold, hard facts that count are: *performance, production, low tonnage cost.* Figure your costs with P&H Electric Shovels and you'll find a convincing difference. It explains why every third P&H Electric Shovel sold is a repeat order.

*T. M. of Harnischfeger Corporation for electro-magnetic type clutch.

P&H ELECTRIC SHOVELS
4454 West National Avenue
Milwaukee 14, Wisconsin
HARNISCHFEGER CORPORATION

Every third P&H Electric Shovel sold is a repeat order

EXCAVATORS • OVERHEAD CRANES • HOISTS • ARC WELDERS AND ELECTRODES • SOIL STABILIZERS • CRAWLER AND TRUCK CRANES • DIESEL ENGINES • PRE-ASSEMBLED HOMES



Heavy Media Recovery Improved 9 Ways

DINGS TYPE HM CROCKETT SEPARATOR RECOVERS 99.8%, IS SMALLER, LIGHTER, COSTS LESS*

THE heavy media concentration process** is coming into its own. A big reason why is the economical recovery of medium pioneered and brought to peak efficiencies by the Dings Crockett Separator. Now—in the type HM—this separator has been greatly improved. Recoveries are even higher—99.89% in at least one case—and its operation is virtually foolproof. It will pay potential and current users of the heavy media process to investigate the type HM fully.

AIEE Paper on Heavy Media Process Available Free

Co-authored by K. A. Blind of Dings and J. J. Bean of American Cyanamid, this 9-pg. paper will be of considerable help to anyone interested in the potentials of the Heavy Media Process. Write:

DINGS MAGNETIC SEPARATOR COMPANY
4716 W. Electric Ave., Milwaukee 46, Wis.

IMPROVED FEATURES OF DINGS TYPE HM CROCKETT

1. Incorporates 6 magnet poles compared to 8. Purity of concentrate remains the same; recoveries are considerably improved.
2. New design permits lower cost.
3. Floor space reduced 53%; head room reduced 34 inches.
4. Magnetic intensity increased 15%.
5. New undershot feed arrangement provides greater medium recoveries.
6. Side overflows eliminated; this product now discharged adjacent to the tailings valve. No piping is needed.
7. Sealed self-aligning ball bearings on head and tail pulleys.
8. New self-adjusting belt tightener.
9. Integral tank and frame assembly permits standardization irrespective of head room requirements.

DINGS SEPARATORS HAVE BORNE AMERICAN CYANAMID COMPANY'S APPROVAL FOR OVER 10 YEARS.

Dings Magnets

**Dings Mag. Sepr. Co. is the only manufacturer licensed to build the Crockett Magnetic Separator.*

***The Heavy Media Separation Processes are licensed by American Zinc, Lead and Smelting Co. American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y., are their sole technical and Sales Representatives for these processes.*

Refractories

a good target for greater furnace production

In addition to the complete line of furnace refractories, which includes high duty and super-duty fireclay brick and high-alumina brick of all classes, Harbison-Walker provides acid-resisting brick for structures exposed to acids and corrosive fumes, insulating brick, mortars for all types of brick; plastic and castable refractories and ramming mixtures.

Changes in furnace design and operation—aimed at greater production of metal—impose increasingly severe conditions upon the refractories of which furnaces are built. Higher temperatures, increased activity of chemical reactions, larger volumes of metal, slag and gases—these are some of the conditions that must be compensated for if accelerated production schedules are to be fulfilled.

Important benefits are derived from the use of such outstanding brands as the following:

CHROMEX B in copper refining furnaces and converters, lead refining furnaces and in aluminum melting furnaces.

H-W PERIKLASE in various furnace bottoms.

METALKASE in upper side walls and roofs of metallurgical furnaces.

FORSTERITE for basic roofs in electric furnaces and copper holding furnaces.

H-W MAGNESITE, MAGNEX, H-W CHROME and **CHROMEX** for various basic refractory requirements.

VEGA super-duty silica brick and **STAR** silica brick for roofs of refining and smelting furnaces.

Harbison-Walker Refractories Company
AND SUBSIDIARIES
WORLD'S LARGEST PRODUCER OF REFRACTORIES
General Offices • Pittsburgh 22, Penna.

Garlock
"Chevron" Seal

Wherever leakless operation is required—specify GARLOCK Mechanical Seals

When leakless operation of centrifugal or rotary pumps is required—particularly, if corrosive or inflammable liquids are being handled—GARLOCK Mechanical Seals will do the job.

These seals are composed of two main elements; one rotates with the shaft and the other is stationary. Since the stationary element does not contact the shaft, there is *no* wear on the shaft. A positive contact between carefully lapped metal-to-carbon or, metal-to-metal mating surfaces provides the leakless seal.

Users of GARLOCK Mechanical Seals have reported outstanding service records on a wide variety of applications. Here are just two taken from the many in our files:

- Over 3 years' service and still in operation, on a 1¾" shaft of a boiler feed pump handling water at 220°F. and 200 p.s.i., and operating at 3600 r.p.m.
- Two years' service, and still in operation, on a 1" shaft of a pump handling paint at 130°F., 10' Hd., operating at 1750 r.p.m.

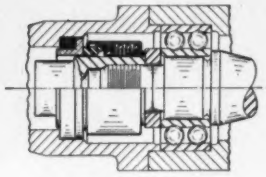
GARLOCK manufactures mechanical seals in many standard and special designs from a wide range of high quality materials. For more information, write for our Mechanical Seal booklet or call your GARLOCK representative.

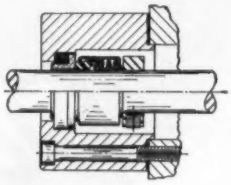
THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

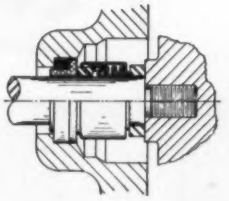
GARLOCK

TYPICAL APPLICATIONS of GARLOCK Mechanical Seals for Rotary Shafts

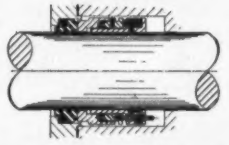
PACKAGE SEALS





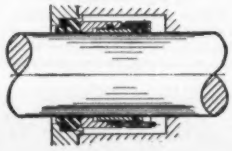


CHEVRON-TYPE SEALS

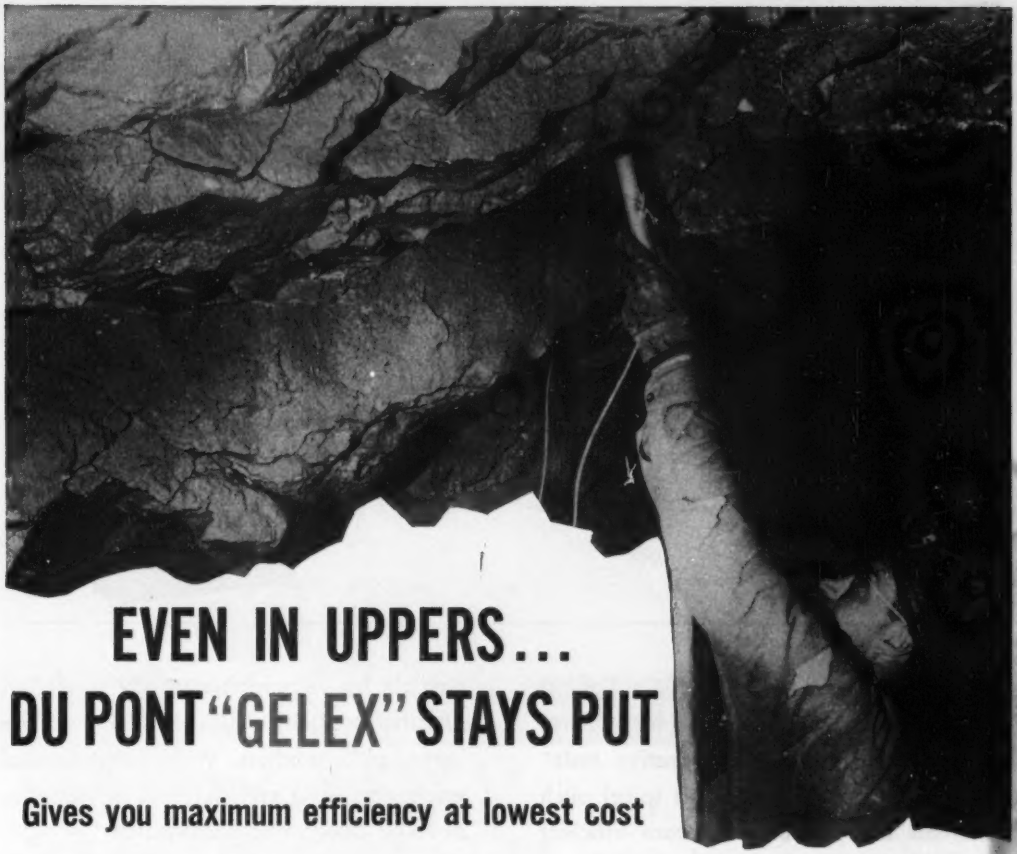


Type CB—Balanced "Chevron" Seal

"O" RING SEALS



Type OB—Balanced "O" Ring Seal



EVEN IN UPPERS... DU PONT "GELEX" STAYS PUT

Gives you maximum efficiency at lowest cost

Du Pont "Gelex" combines the economy of low-density dynamites with the water resistance, cohesiveness and high strength of gelatins. "Gelex" is highly suitable for a wide variety of ore mining operations, and it's a favorite with mining men everywhere.

IT'S COHESIVE. When you put "Gelex" in uppers, it stays there. That's because it is plastic, cohesive and is supplied in perforated cartridges which eliminate raveling and assure concentration of the charge at the back of the hole . . . where it will do the most good.

IT'S ECONOMICAL. Stick for stick, "Gelex" costs less than gelatins of comparable strength. The excellent water resistance of "Gelex" frequently permits it to be substituted for more expensive gelatin grades.

IT'S EFFICIENT . . . Fragmentation is excellent in hard, soft or intermediate ore. In addition, "Gelex" has very good fumes.

You'll appreciate Du Pont "Gelex" in your operations. It gives you dependable performance and increased economies. Contact the Du Pont Explosives representative in your area. He will be glad to give you complete information and assist you in any way he can. E. I. du Pont de Nemours & Co. (Inc.), Explosives Dept., Wilmington 98, Del.

Listen to "Cavalcade of America"—Tuesday evenings—NBC

DU PONT EXPLOSIVES

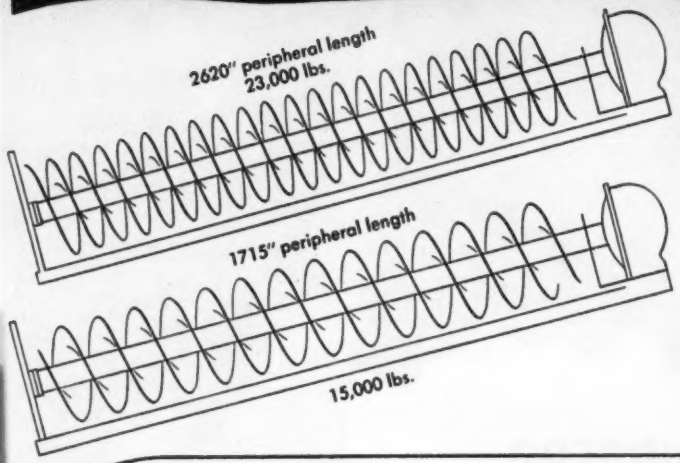
BLASTING SUPPLIES AND ACCESSORIES

DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

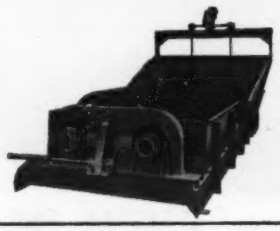
AKINS classifiers have 50% more capacity



MORE FLIGHTS

(Conveying Surface)

Per Foot in Akins Construction



The Akins Classifier uses the tightest (shortest pitch) spiral offered for mineral beneficiation. Careful comparative tests* prove that the standard Akins spiral pitch (one-half the diameter) is more efficient than spirals with longer pitches.

Because there is more steel in an Akins spiral, the initial cost is a little more, but this is quickly returned by the profits made possible by dependable steady operation at rated capacity PLUS, or 150% of the longer pitch machine. Write for details of mechanical and metallurgical advantages of Akins design and construction.**

*A report of a technical investigation on the comparison of spiral capacities at different pitches is available. Ask for Technical Investigation No. 51.

**Ask for Bulletin No. 48 for closed circuit grinding, or No. 48-S for specialized applications that may solve your particular problem.

Licensed Manufacturing Representatives

Canadian Locomotive Co., Ltd.....Kingston, Ontario
Head, Wrightson & Co., Ltd.....Stockton on Tees, Eng.
John Carruthers & Co. (Pty.) Ltd.....Sydney, Australia
Head, Wrightson & Co., S.A., (Pty.) Ltd.....Johannesburg

Authorized Sales Agents

Continental Sales & Equipment Co.....Hibbing, Minn.
Ponsford-Moos de Mexico, S.A.....Mexico City, D.F.
Edward J. Nell Co.....Manila, P.I.
Wright Bros., Credit Foncier Bldg.....Vancouver, B.C.

NO IMPORTANT AKINS INSTALLATION HAS EVER BEEN REPLACED BY ANY OTHER CLASSIFICATION EQUIPMENT

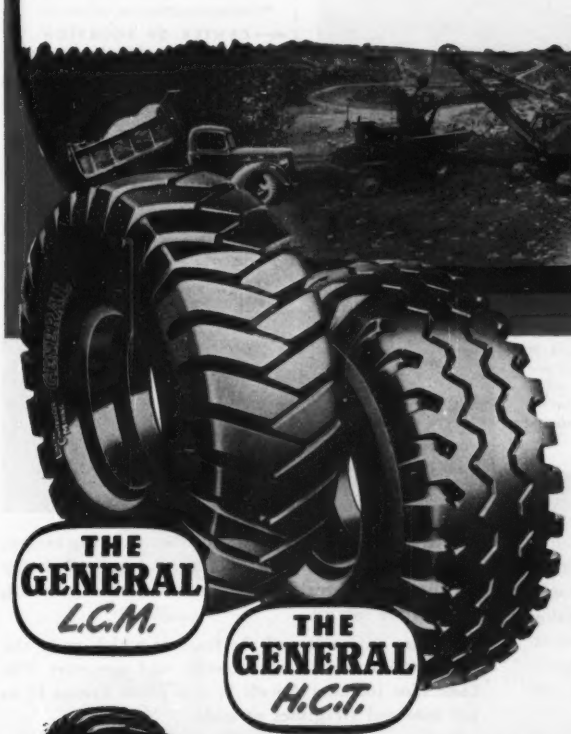
THE COLORADO IRON WORKS COMPANY

Colorado Iron Works Co.

1624 17TH STREET DENVER 2, COLO.

Up steep hills—on loose gravel and sand piles over sharp rocks—slush, mud, gravel—out and over the highway **GENERALS** deliver more loads

Faster! Easier! At Lower Cost!



GENERAL L. C. M—for most work off-the-road. Massive tread and thick, tough shoulders develop extra traction. Extra wear on tough, jagged surfaces. Stronger rayon cord body with more natural rubber built into its shock-absorber design.

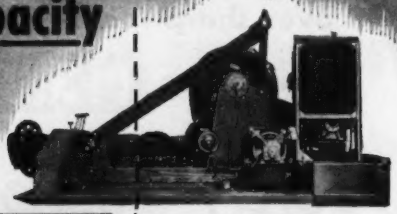
GENERAL H. C. T.—for more work on-the-road. Thick, saw-tooth tread supported by broad, angled shoulder cleats develop extra traction. Smoother rolling, quicker stopping. More original and more recap miles.

GENERAL UNDERGROUND MINING TIRE

This specially designed, ruggedly built, thick-shouldered mining tire will assure more uninterrupted hours of work. More maneuverability.

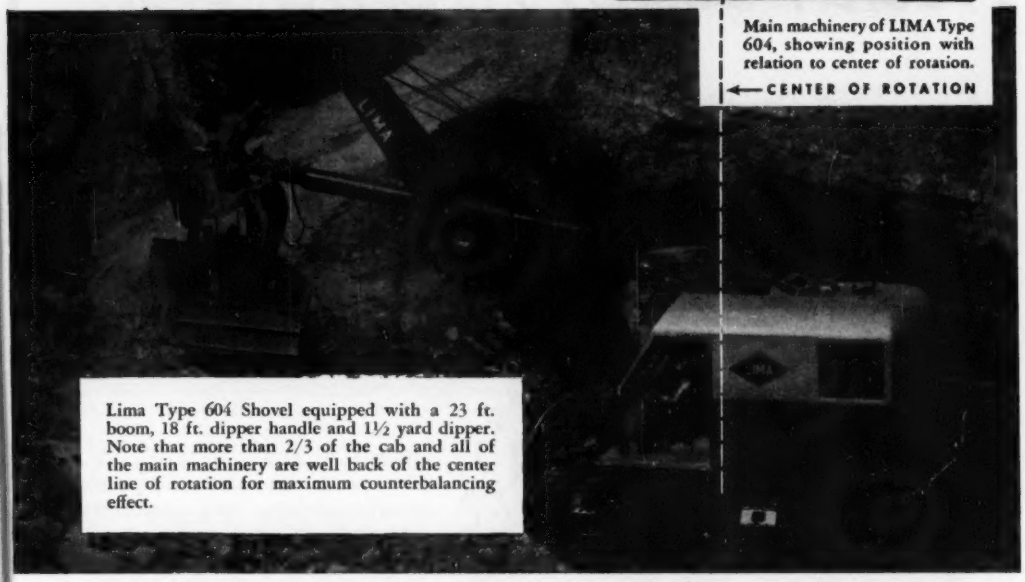
REQUEST GENERAL TIRES ON YOUR NEW EQUIPMENT

Why the LIMA Type 604 develops the greatest capacity per lb. of weight



Main machinery of LIMA Type 604, showing position with relation to center of rotation.

←CENTER OF ROTATION



Lima Type 604 Shovel equipped with a 23 ft. boom, 18 ft. dipper handle and 1½ yard dipper. Note that more than 2/3 of the cab and all of the main machinery are well back of the center line of rotation for maximum counterbalancing effect.

● The LIMA Type 604 shovel, crane and dragline is engineered to produce greatest capacity with minimum weight. This is achieved by placing as much weight as possible *behind* the center of rotation—eliminating the need for excessive counterweight. Hook rollers on which the machinery base revolves eliminate strain from the center pintle—permitting continuous, safe operation at full capacity.

The simple, compact design of the main machinery, using the fewest number of shafts to accomplish the various operations, further contributes to efficient, trouble-free service.

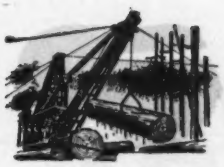
These are only a few of the features which make the LIMA 604 a favorite with owners and operators. The Lima Line includes shovels ¾ to 6 yards, Cranes 13 to 110 tons and Draglines variable.

BALDWIN-LIMA-HAMILTON CORPORATION
LIMA-HAMILTON DIVISION
LIMA, OHIO, U. S. A.

BALDWIN · BLH · LIMA-HAMILTON

SALES AGENTS IN PRINCIPAL CITIES OF THE WORLD

BALDWIN-LIMA-HAMILTON

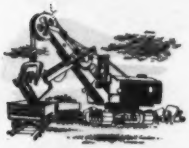


For Logging

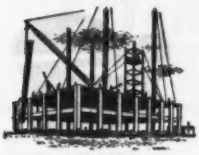
For Sand and Gravel

For Aircraft

For Marine



For Stone Quarries

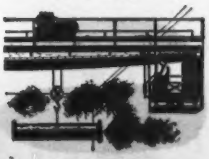


For Construction

For Elevators

For Mining

For Drilling



For Industrial

For better service and more economy

MACWHYTE

PREformed... Internally Lubricated

WIRE ROPE

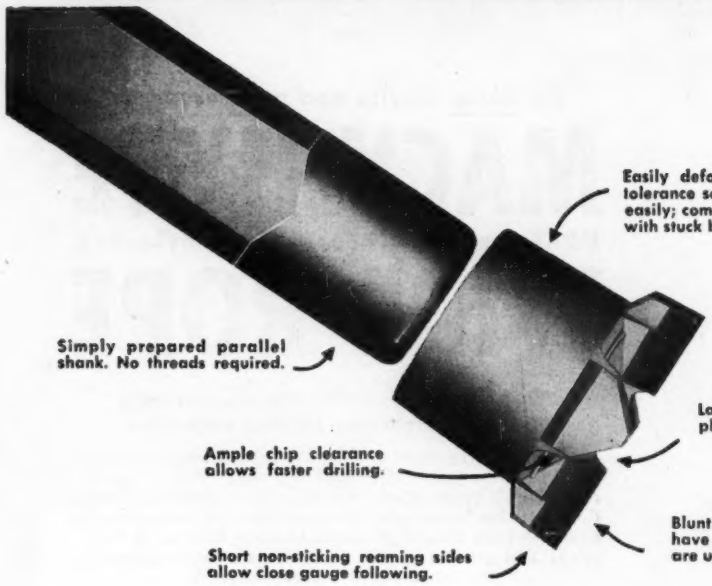
A thousand and one **to order from assures the right rope for your equipment**

It will pay you to get Macwhyte Wire Rope, engineered and job-proved for your particular equipment. Over the years, ropes for all types of equipment in every field have been developed by Macwhyte. Recommendations are promptly available from Macwhyte distributors or Macwhyte Company. You get the correct wire rope for your equipment when you buy Macwhyte.

MACWHYTE COMPANY, 2937 Fourteenth Avenue, Kenosha, Wis. Manufacturers of Internally Lubricated PREformed Wire Rope, Braided Wire Rope Slings, Aircraft Cables and Assemblies, Monel Metal and Stainless Steel Wire Rope. Catalog available on request. Mill depots: New York • Pittsburgh • Chicago • Minneapolis • Fort Worth • Portland • Seattle • San Francisco • Los Angeles • Distributors throughout U.S.A.

BULLETIN 5025 gives information on "How to order Wire Rope" and lists all sizes and constructions of Improved Plow Steel Monarch Whyte Strand Wire Rope. Copy sent on request.

THROWAWAY


Easily deformable skirt with close tolerance socket hole . . . bit goes on easily; comes off easily; no lost time with stuck bits.
Simply prepared parallel shank. No threads required.
Large hemispherical non-plugging water outlet.
Ample chip clearance allows faster drilling.
Blunt non-breaking cutting edges have self-sharpening tendency — are uniformly hard.
Short non-sticking reaming sides allow close gauge following.

LOWER YOUR DRILLING COSTS

with

THE "ORIGINAL" ONE-USE BIT

Increased Rod Life with this Strongest and Cheapest Connection

Maximum Footage – Above Average Hardness

Minimum Breakage with Tougher Sockets

Made in All Gauges

THE "TEST" WILL PROVE ITS WORTH

THROWAWAY BIT CORPORATION

4200 N.W. Yeon Ave. **Portland, Oregon, U.S.A.**

Fully descriptive literature on all products is available. Competent field engineers and dealers are always at your service.

Some territories still open for distributors and jobbers.

GOULD

Plus-Performance Plan

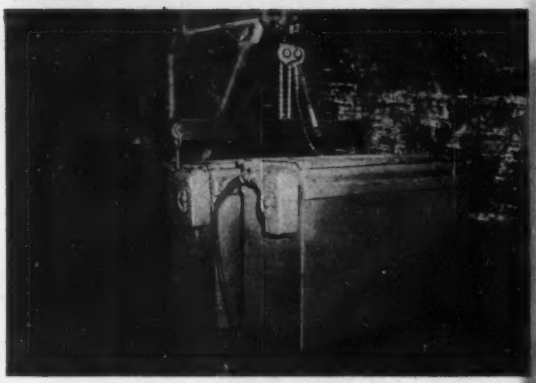
. . . SHOWS YOU HOW

CORRECT CHARGING

EXTENDS BATTERY PERFORMANCE!

Right now, the problem of conserving and extending essential battery power is urgent. Timely help is offered you by the GOULD PLUS-PERFORMANCE PLAN which can improve battery performance as much as 50%! Here is a complete system of manuals, articles, specifications, bulletins, record cards and charts which explains and illustrates how to select, charge and handle, maintain and determine the condition of your batteries.

The material comprising the GOULD PLUS-PERFORMANCE PLAN is available to battery users without obligation. A request on your letterhead will bring descriptive literature by return mail.



Jib cranes make battery handling quick and easy.

The Gould "Thirty" with "Z" Plates—America's Finest Mining Battery

FOUR SIMPLE CHARGING RULES SAVE POWER

1. Do not overcharge. Use 22.5 amperes per 100 ampere-hours of battery capacity for 80% of charging time. Finish charge at 5 amperes per 100 ampere-hours. Correct charging will not cause gassing or overheating.
2. Give periodic equalizing charges. An extra 4-hour charge at the recommended finish rate at least once a month but not more often than once a week makes sure all cells are up to full charge.
3. Keep idle batteries charged. Batteries not in use should be given a freshening charge once every three months to prevent internal discharge, sulphating and eventual loss of efficiency.
4. Inspect charging equipment regularly. Make sure it is set correctly for the size of batteries to be charged. Inspect voltage relay timers frequently to assure accurate automatic cut-off. If ampere-hour method is used, check ampere-hour meter charts for correct settings.

GOULD

STORAGE BATTERIES

GOULD-NATIONAL BATTERIES, INC., TRENTON 7, NEW JERSEY

Always Use Gould-National Automobile and Truck Batteries

Only Carlon

THE FIRST REAL PIPE THAT IS PLASTIC!

TO SOLVE MAINTENANCE AND REPLACEMENT PROBLEMS in any type of mine, specify CARLON plastic pipe. Guaranteed against rot, rust and electrolytic corrosion, it has a trouble-free service life many times longer than ordinary pipe. CARLON is completely resistant to the chemical action of sulphurous waters, alkalies, metallic salts, and other corrosive wastes.

CARLON is lightweight and can be handled easily—no heavy materials handling equipment or special tools needed. Its smooth internal surface will not accumulate scale and minimizes frictional loss.

Flexible CARLON is produced in all standard pipe sizes. It is supplied in long lengths which require fewer fittings per installation and conform to irregular surface contours as well as slope or entry direction.

A complete line of molded plastic fittings incorporating standard I.P.T. is available for plastic-to-plastic or plastic-to-metal connections.

To obtain the most durable mine pipe produced today, specify CARLON.

268-CP

At present, raw material shortages are limiting the production of certain types of CARLON pipe. Every effort is being made to overcome this problem and to meet the demand for CARLON . . . the first real pipe that is plastic.

CARLON CP

CARLON PRODUCTS CORPORATION

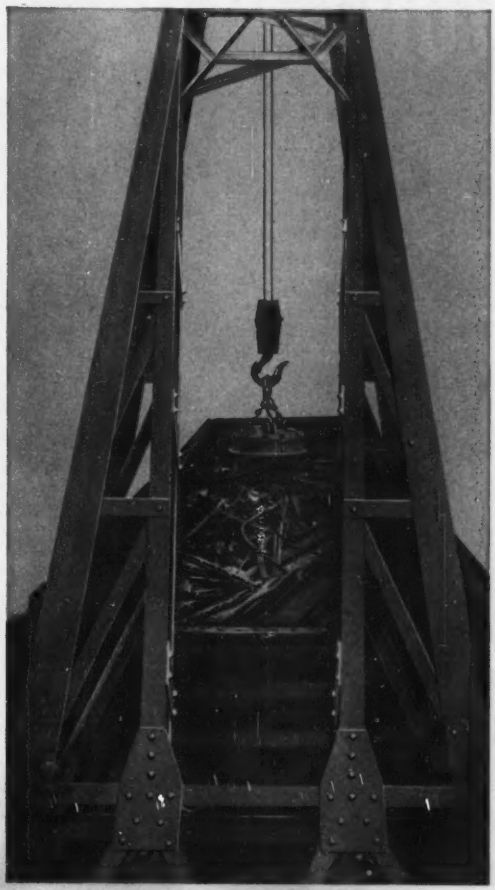
IN CANADA: MICRO PLASTICS, LTD., ACTON, ONT.
10220 MEECH AVE. • CLEVELAND 5, OHIO

BROWNHOIST – THE ONLY LOCOMOTIVE-CRANE CAB THAT PROVIDES A CLEAR VIEW IN EVERY DIRECTION

Approximate visibility from ordinary cab.

Approximate visibility with operator on side.

360 degree visibility from new Industrial Brownhoist Monitor-Type Cab.



Mounted high in the crane and surrounded by large windows, the operator in a Brownhoist patented Monitor-Type cab has full 360° visibility – forward, backward, and to both sides – providing safer operation, faster, more efficient loading and unloading. In addition the new Clear-Vision Boom is another Brownhoist feature that permits the operator an unobstructed view of his work. When unloading from high-walled railroad cars he can see right into the car.

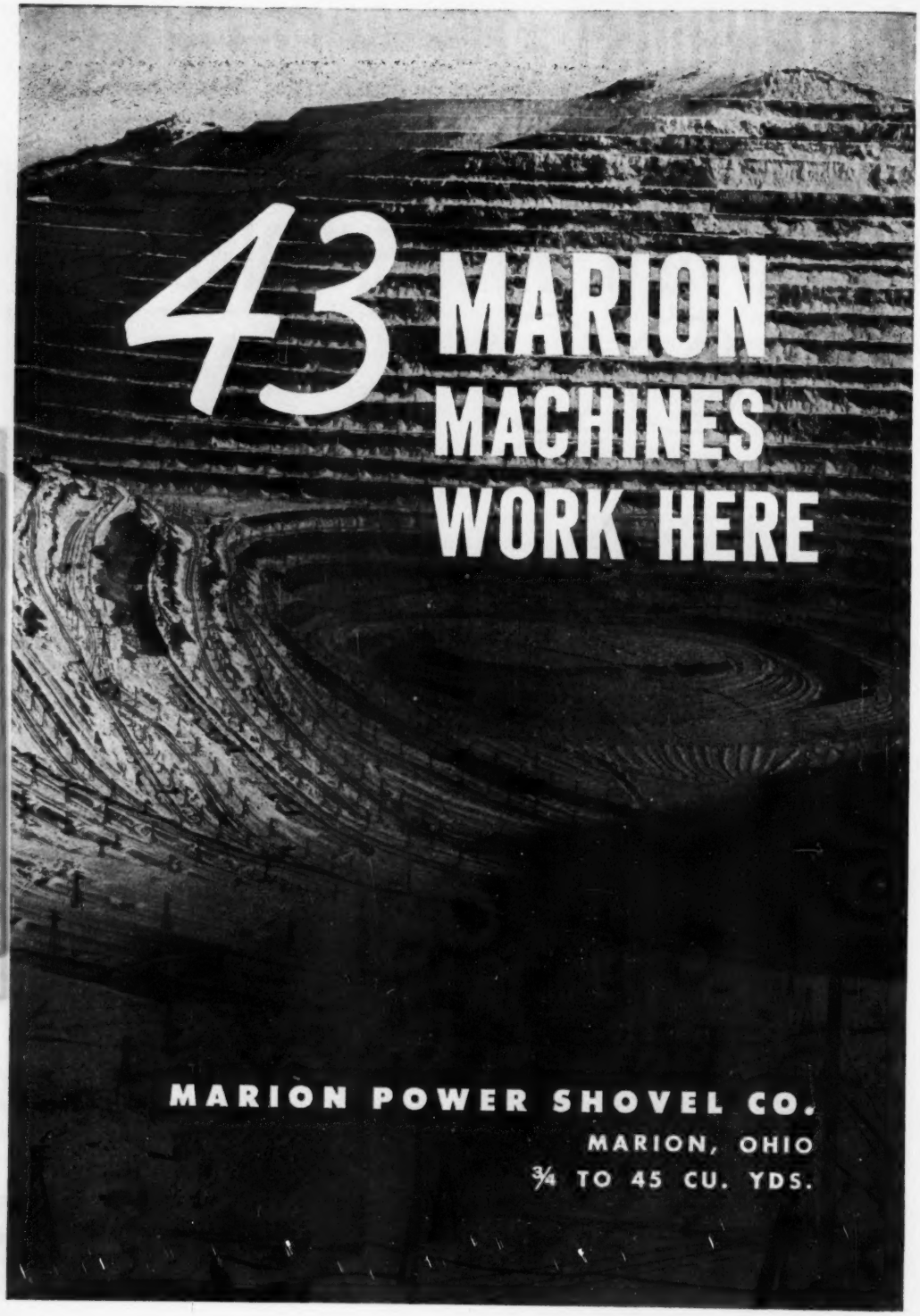
The Monitor-Type cab is also designed for the safety and comfort of the operator. All controls are conveniently located and can be easily reached from a comfortable, well-raised seat. There's a soundproof partition between the operator and the machinery. There are doors on both sides of the cab and there's a 14" safety clearance between car body and rotating upperworks.

Brownhoist Diesel and Diesel Electric Locomotive-Cranes are available in capacities from 20 tons up for speeding materials handling with magnet, hook or bucket. Write today for complete information.

BROWNHOIST BUILDS BETTER CRANES

INDUSTRIAL BROWNHOIST CORPORATION, BAY CITY, MICHIGAN

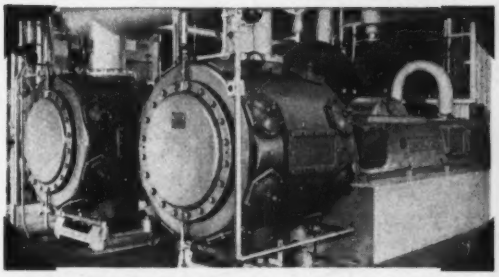
DISTRICT OFFICES: New York, Philadelphia, Cleveland, San Francisco, Chicago, Canadian Brownhoist Ltd., Montreal, Quebec. **AGENCIES:** Detroit, Birmingham, Houston, Los Angeles. 148


43 MARION MACHINES WORK HERE
MARION POWER SHOVEL CO.
MARION, OHIO
¾ TO 45 CU. YDS.

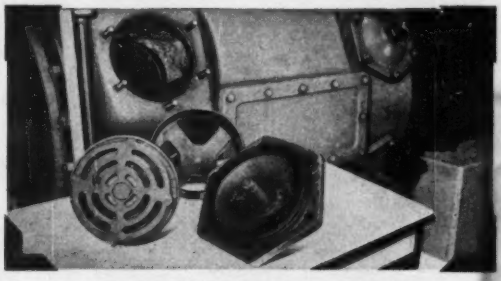
STANDARD ENGINEER'S REPORT

DATA
LUBRICANT Calol Multi-Service Oils
UNIT Compressor cylinders - 30"X20" parallel
LUBRICATOR Force-feed
CONDITIONS Furnishes furnace stack draft and compresses flue gas — high chemical content
PERIOD 2 years
FIRM Pure Carbonic Co., Berkeley, Calif. (A Division of Air Reduction Co., Inc.)

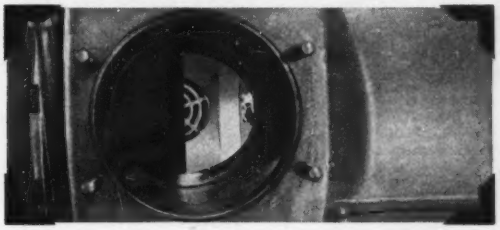
Special oil cuts wear in compressor handling corrosive gas



CALOL MULTI-SERVICE OIL 55X held wear down in these thirty-inch compressor cylinders to an average of only 0.0015 inch in two years, although they handle only raw flue gas. This is part of Pure Carbonic Company's process for producing CO_2 to make "Dry Ice."



OXYGEN, NITROGEN, SULPHUR and carbon dioxide are some of the chemicals in the millions of cubic feet of flue gas from furnace stacks that go through the compressor in a day. A valve has been removed showing where deposits from corrosive elements may accumulate.



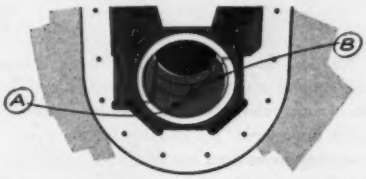
PORTION OF A CYLINDER, seen through a valve port, shows how CALOL Multi-Service Oil 55X keeps walls clean and lubricated. It withstands the highest operating temperatures, keeps a uniform lubricating film on all surfaces and is especially resistant to lacquer formation.

REMARKS: The compressor pictured here is an Ingersoll-Rand Type XPL. (30X20" Compressor Cylinders; 13x20" Steam.) The gas it handles in 24 hours produces 120,000 pounds of liquid carbon dioxide. CALOL Multi-Service Oil 55X lubricates the journals and crankpins as well as cylinders. There are grades of CALOL Multi-Service Oil to meet conditions in all types of compressors.

CALOL

Trademark "CALOL" Reg. U. S. Pat. Off.

How CALOL Multi-Service Oil cuts costs in all types of compressors



In crankcase and on cylinders, CALOL Multi-Service Oil reduces oil consumption -- has cut consumption 20% in air compressors.

A. Oxidation-resistant compounds prevent formation of varnish. Detergent keeps contaminants suspended in oil, prevents foam.

B. Special compound assures "hot-spot" lubrication ... covers surfaces rapidly.

CALOL Multi-Service Oils also recommended for pumps, diesel engines, enclosed gears.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any of the companies listed below.

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street • San Francisco 20, California

THE CALIFORNIA COMPANY
P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 • El Paso, Texas

There's a better way to separate your minerals . . .

Use Armour's Flotation Reagents !

Froth flotation, the modern milling method, means longer life, greater productivity and more economical separations for your mine. Yields of a given ore are raised by: (1) making separations once considered economically impossible, (2) making higher grade concentrates possible, (3) recovering more than one concentrate and (4) concentrating minerals lost in tailings.

Vital to profitable flotation is the uniform high quality of the reagents. The pioneering Armour Chemical Division produces a wide range of quality chemical reagents—both anionic and cationic. In the anionic category are Armour's fractionally distilled fatty acids. The cationic group includes the high molecular weight aliphatic amines and their water soluble amine salts, as well as quaternary ammonium salts. Armour manufactures these fatty acids and fatty acid derivatives under the strictest chemical control.

If you have a separation problem involving the listed ores and their associated minerals, Armour's technical service staff may provide the answer. Write today for more information.

PROVEN SEPARATIONS

Amblygonite • Barite • Beryl
Cement Rock • Chromite
Feldspar • Fluorspar
Hematite • Ilmenite
Kaolinite • Magnetite
Manganese • Manganite • Mica
Phosphate • Potash • Salt
Silica • Spodumene
Syenite • Talc • Tin
Vermiculite

Specialists in Flotation Chemicals

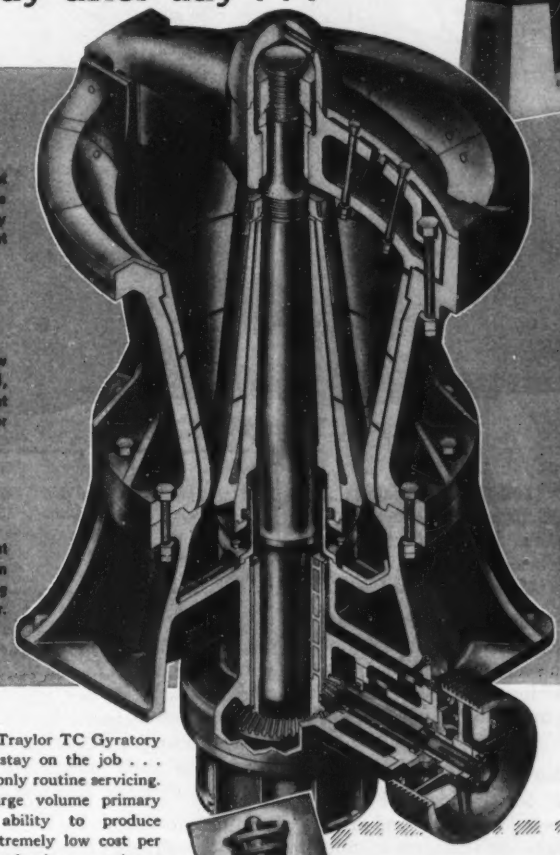
ARMOUR *Chemical Division*

Armour and Company • 1355 W. 31st Street • Chicago 9, Illinois

there are 6 reasons why a

Traylor TC Gyratory

can produce huge tonnages day after day . . .



1 Straight line bar type cast steel spider has an extra heavy hub. Absolutely non-wearing. Simple but strong.

2 Main shaft, forged of low carbon high grade steel, is of minimum length but of maximum diameter for greater strength.

3 The patented Traylor dust seal is positive protection against dust and grit getting into the lubrication chamber.

4 Traylor's original self-tightening bell head and curved concaves practically eliminate choking and packing . . . save power waste by applying power as a direct crushing force.

5 A positive, automatic pump-type lubrication system has a water cooled oil reservoir.

6 Self contained counter shaft bearing . . . fitted with roller bearings . . . is automatically lubricated as is the machine cut steel gearing used in the Traylor T.C.

The rugged design of a Traylor TC Gyratory gives it the stamina to stay on the job . . . *day after day* . . . with only routine servicing. It accounts for this large volume primary crusher's outstanding ability to produce huge tonnages at an extremely low cost per ton. If you need more production . . . or lower costs . . . you need a Traylor TC Gyratory. Send for free literature that gives full details.

Mail Coupon For Full Information

TRAYLOR ENGINEERING & MANUFACTURING CO.
3184 Mill St., Allentown, Pa.

I want to know all about a Traylor TC Gyratory

Name _____

Company _____

Address _____

SALES OFFICES: New York, N.Y.; Chicago, Ill.; Los Angeles, Calif.
CANADIAN MFRS: Canadian Vickers, Ltd., Montreal, P.Q.

Traylor

Rotary Kilns, Coolers and Dryers • Grinding Mills
Jaw, Reduction and Gyratory Crushers • Crushing Rolls
Apron, Grizzly, Slurry and Table Feeders.

A "TRAYLOR" LEADS TO GREATER PROFITS

GM Diesels Cost Less to Maintain

"MAINTENANCE expense on our GM Diesels is lower than on other makes of power," states E. E. Coleman, manager, Bradley Mining Co. The Bradley fleet includes five Euclid trucks and four Koehring dumptors—*all GM Diesel-powered.*

GM Diesel's 2-cycle operation means less wear and tear on parts, longer engine life. Because power is delivered on every piston downstroke, pistons and other moving parts do not have to travel nearly as far to produce a given power output.

Two-cycle design also makes GM Diesels far more compact than other Diesels of equal horsepower. Parts are lighter weight and easier to get at. GM unit injectors eliminate troublesome high-pressure fuel lines and are individually replaceable.

One of a fleet of five GM Diesel-powered Euclids owned by Bradley Mining Co., Stibnite, Idaho, nation's largest producer of antimony ore.

Finally, all GM Series 71 engines have the same cylinder size, which means that most parts are interchangeable in any unit from 2 to 24 cylinders. Interchangeability of low-cost Factory-Engineered parts saves mechanics' time and reduces parts inventories. It cuts down service time—keeps GM Diesels on the job.

For full information on these hard-working, easy-to-maintain 2-cycle Diesels, consult your nearby GM Diesel distributor or write us direct.

ANSWER THE CALL CIVIL DEFENSE

DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES...Up to 275 H.P. **DETROIT 28, MICHIGAN** MULTIPLE UNITS...Up to 800 H.P.

GENERAL MOTORS

GM GENERAL MOTORS DIESEL POWER

DIESEL BRAWN WITHOUT THE BULK

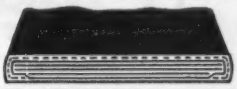
Republic Tips to Conveyor Belt Users . . .

1. SELECT PROPER TYPE BELT CONSTRUCTION

. . . a job for your Republic Distributor

REGULAR FOLDED CONSTRUCTION *(For general duty only)*

STEP PLY CONSTRUCTION *(Gives better troughing action)*



BREAKER STRIP CONSTRUCTION FOR EXTRA PROTECTION

(Against Heat or the Effects of Heavy Abrasive Loads)

NOTE: Conveyor Belt wear is generally greater at the edges and lower outside surfaces—Extra cover thicknesses at these points give Republic Belts added protection.

It takes more than a conveyor belt purchase to reduce your material handling costs.

The belt must be constructed right, installed right and serviced right.

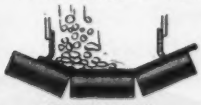
Selection, application and service are items best left to an expert. Your Republic Distributor is that man.

He is prepared to make specific recommendations to save you time and money. Contact him today for a free analysis of your plant needs. He can quickly tell whether or not you're getting maximum benefits from present installations, and, if trouble exists, he's fully qualified to suggest corrective changes.

For 50 years Republic Rubber has specialized in Industrial Rubber Products, making all types of hose, belting, molded and extruded rubber products.

Remember, you save the most when you use the best—correctly!

2. MAKE SURE YOUR BELT IS PROPERLY INSTALLED & MAINTAINED—*full facts from your Republic Distributor*



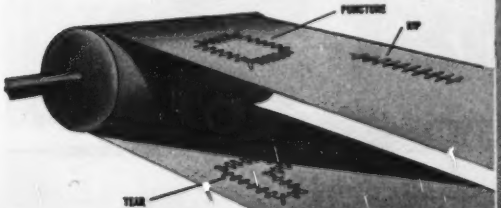
WRONG LOADING

WRONG

CORRECT LOADING

RIGHT

3. NEVER DISCARD DAMAGED BELTS WITHOUT CONSULTING YOUR REPUBLIC DISTRIBUTOR ABOUT POSSIBLE REPAIRING



Quick remedies are available for many seemingly fatal accidents.

INDUSTRIAL RUBBER PRODUCTS BY

REPUBLIC RUBBER DIVISION

LEE RUBBER & TIRE CORPORATION

YOUNGSTOWN, OHIO

MACK TRUCKS

See You Through

• There are many good reasons why a Mack is your best truck investment during times like the present. Most important of all is the undisputed fact that Mack trucks outlast them all.

This means that with a Mack truck you can face the uncertainties of the future with assurance...confident that even if trucks should become hard to replace your Mack will see you through...that it will stay on the job delivering dependable service mile after mile and year after year.

Thousands of truck users in World War II found out by actual experience that they were indeed "Lucky to own a Mack." Whatever the future may bring, you'll find that for a sound investment in long-term reliability and operating economy there's no other truck to match a Mack.

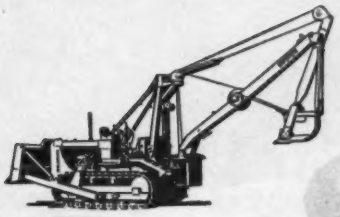
Your nearest Mack branch or distributor will give you the full story on what "Built Like A Mack" means in *extra* long life, *extra* strength and stamina, *extra* performance and *extra* dependability.

Mack TRUCKS

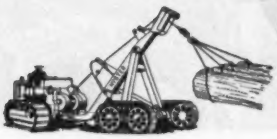
...outlast them all

Mack Trucks, Empire State Building, New York 1, N.Y. Factories at Allentown, Pa.; Plainfield, N. J.; Long Island City, N. Y. Factory branches and distributors in all principal cities for service and parts. In Canada: Mack Trucks of Canada, Ltd.

In rigorous coal stripping service, big Mack Model LRSW six-wheel trucks have won an outstanding reputation for "seeing things through" with long-lasting, dependable operation.



HYSTAWAY
EXCAVATOR - CRANES



LOGGING ARCHES
AND SULKIES

GRID ROLLERS

TRACTOR WINCHES

Hyster Towing Winches...
Hystaway Excavator-Cranes...
Logging Arches and Sulkies...
Grid Rollers... Yarders and Donkeys—
are Working All Over The World

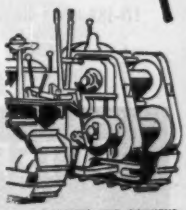
FOR 22 YEARS Hyster has been manufacturing TOWING WINCHES and some 30 OTHER TRACTOR TOOLS for Caterpillar-built tractors.

FOR 22 YEARS Caterpillar dealers ALL OVER THE WORLD — more than 400 — have been selling Hyster tractor tools.

NOW well over 40,000 satisfied owners USE Hyster TRACTOR TOOLS.

Any Caterpillar dealer can tell you about Hyster equipment.

HYSTER



YARDERS AND DONKEYS

WORLD'S LARGEST MANUFACTURER OF TRACTOR WINCHES

HYSTER COMPANY

2965 N. E. CLACKAMAS STREET, PORTLAND 8, OREGON
1865 NORTH ADAMS STREET, PEORIA 1, ILLINOIS

CLOSER TO COAL WITH EVERY PASS—Speed, easy handling and rugged ability make Internationals the favorites for coal strip mining near Pleasant View, Illinois.

DOUBLE EXPOSURE

AT PLEASANT VIEW

Two Internationals peel off clay and rock to expose coal at reduced cost for Paisley and Smith

Thirty feet beneath the pleasant view near Pleasant View, Illinois, is a coal layer well worth getting out. But first Paisley & Smith Company had to doze off a thick layer of heavy, sticky, wet clay, followed by a layer of rock.

They teamed up two big red Internationals—a TD-24 and a TD-18A—and did the job in jig time. Owner Smith and both operators were enthusiastic, and here's what they have to say:

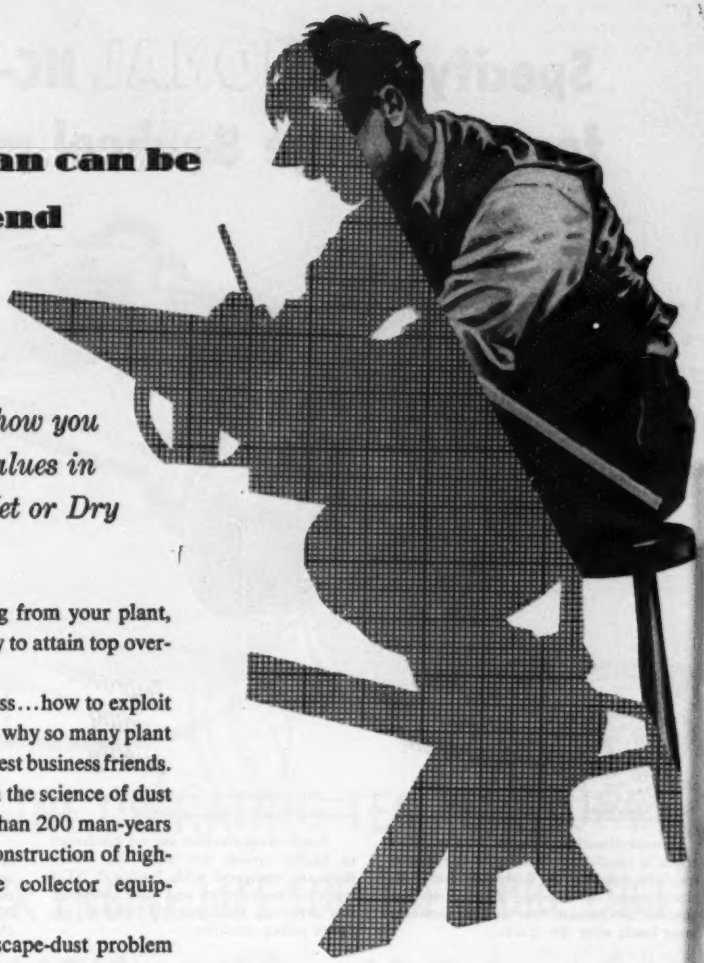
"Both these tractors do a wonderful job for us," they report, "and the TD-24 is the best machine for a strip mine we know of. It's tremendously powerful and quick and easy to handle. It does more work than other tractors and does it at reduced cost!"

Ask your International Industrial Distributor today for the low-down on "Power that Pays." Check up on his service facilities and complete parts department. Then you'll know how he can keep your equipment in the field paying out in hard work over the years ahead.

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILLINOIS

INTERNATIONAL **POWER THAT PAYS**

This 'dust' man can be your best friend



Let him show you how you can Reclaim the Values in Escaping Dust—Wet or Dry

If valuable dust is escaping from your plant, you're overlooking an opportunity to attain top overall efficiency.

How to recover this dust loss...how to exploit its full value, is Buell's job. That's why so many plant operators include us among their best business friends.

Looked up to as a leader in the science of dust collection, Buell draws on more than 200 man-years of experience in the design and construction of high-efficiency, economical-to-operate collector equipment.

Therefore, if a valuable-escape-dust problem exists in your plant, probably we can help. For full information about Buell techniques and methods write today. Ask for the new 'Dust Recovery' bulletin. Buell Engineering Company, Dept. 19-I, 70 Pine Street, New York 5, N. Y.

'SF' Electric Precipitator separating pyrite ash from flue gas after a Nicholson-Freeman Furnace.

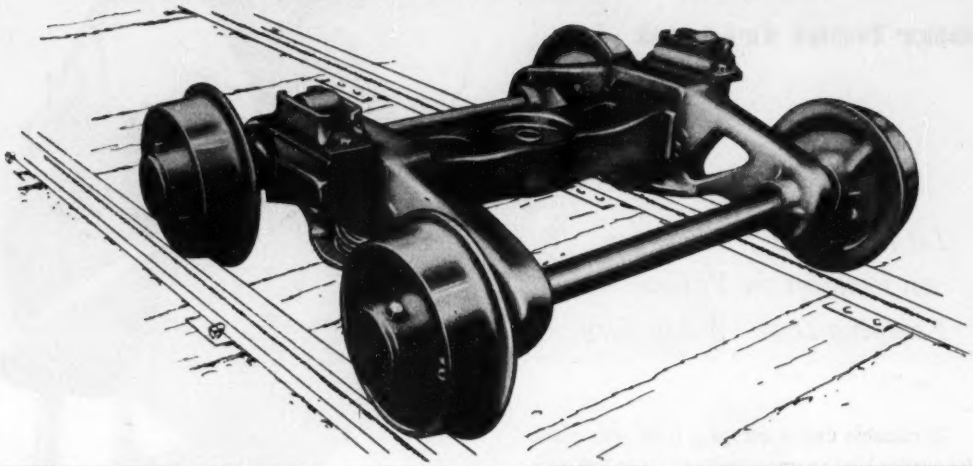
C. E. ROSENBERG, A.S.P.S.

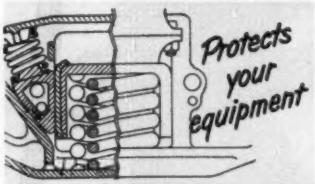
buell® ELECTRIC CYCLONIC

HIGH-EFFICIENCY CYCLONES
ELECTRIC PRECIPITATORS
"LR" COLLECTORS
LOW DRAFT LOSS COLLECTORS
SPECIAL PURPOSE COLLECTORS
DUST HOPPER VALVES

ENGINEERED EFFICIENCY IN DUST RECOVERY

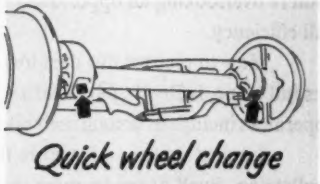
Specify NATIONAL NC-1 trucks for your large 8-wheel mine cars





Shock-absorbing system of the NC-1 truck is similar to designs of the American Association of Railroads for full-size freight car trucks. The oscillation control mechanism (see cutaway) floats your loads over the tracks.

Track irregularities are no hindrance to higher speeds for mine cars when they are equipped with National NC-1 trucks. Truck design and large diameter, low stressed, load-carrying springs improve riding qualities.



Removal of bolt at each end of side frame permits quick wheel and axle assembly change. Cuts repair time and costs . . . keeps cars in operation longer. No lengthy tie-ups for wheel and axle changes on a National NC-1 truck.

The NC-1 truck stays square automatically. V-shaped slots over the axles make it impossible for the truck to get out of square without lifting entire weight of the car body and lading—means longer service, less repairs.

National NC-1 truck's large center bearing provides maximum wear life by reducing per-square-inch loading . . . provides bolster stability. Has easily replaceable centerplate shims and adequate provision for lubrication.

Side frame and bolster are each of one-piece, integrally cast construction similar to the National C-1 trucks used on railroads. Gives maximum strength, minimum weight—has *no welds or rivets to shake loose.*

A-3930

For minimum maintenance time and spillage, plus maximum equipment protection—specify National NC-1 trucks on your next 8-wheel mine car order.

NATIONAL Products FOR TRANSPORTATION AND INDUSTRY M&S Est. 1868

NATIONAL MALLEABLE and STEEL CASTINGS COMPANY

Cleveland 6, Ohio

WILLISON AUTOMATIC COUPLERS • DRAFT GEARS • NACO STEEL WHEELS

This KYSOR Equipped EUCLID passed her 1st portrait while working for The Douglas Mining Company at Chisholm, Minnesota. KYSOR Shutters keep the twin 120 h.p. Diesel engines purring smoothly as it carries 24 ton loads up steep grades in the world-famous Iron Range.

PERFECT ENGINE OPERATING TEMPERATURE MEANS LONGER ENGINE LIFE FOR THESE BIG "EUCS"

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Longer engine life . . . longer productive working periods between major overhauls . . . fuel savings . . . these are the reasons why KYSOR Automatic Shutters are found on so many big "Eucs" the country over!

KYSORS are optional equipment one factory installed by Euclid. Wherever the "big babies" move earth or ore, KYSOR Automatic Shutters save in maintenance and fuel. Write for complete information.

KYSOR
Automatic SHUTTERS

KYSOR HEATER CO. CADILLAC, MICH.

4 WAYS TO "4gain" with a Thew Lorain TL MOTO-CRANE

CLEVELAND CLIFFS IRON CO.

use their 15-ton Lorain Moto-Crane MC-254 at their Hawkins Mine, Nashwauk, Minnesota. Here it works as a clamshell, axle deep in water . . . one of the hundreds of jobs it performs for them. Ask your local Thew-Lorain distributor how you can gain with a Moto-Crane on your mining operations.

To cut corners and costs on the many, scattered odd jobs around your mine, put Lorain Moto-Crane mobility to work. Let the big shovels take care of big production . . . save time and money with Lorain "TL" economy and speed. Here's how:

1. MOVES FASTER

You can highball all over the pit—top speed 33 M.P.H. A Lorain "TL" Moto-Crane has the tractive effort and flotation to negotiate the roughest haul roads and cross country terrain. On a moment's call, you're off to the job with Moto-Crane mobility and speed.

2. COVERS MORE JOBS

More speed means more jobs! At this Cleveland Cliffs mine, the "TL" Moto-Crane is "jack-of-all-trades". It's rushed around wherever needed on this large operation, does a different job every day, sets poles, moves machinery, clams out ditches, loads ore and does anything else that is needed. Mobility is the answer to more jobs at your mine.

3. CUTS COSTS

No need to saddle your big loading equipment with the smaller jobs when a Lorain-TL's on the job. You'll save money because of the lower operating expense of the ¾ yd. Lorain as compared to larger, more expensive machines . . . and you'll gain in pay dirt production when a Lorain "TL" frees those big machines for the bigger jobs.

4. MECHANIZES ALL JOBS

You'll find a Lorain-TL Moto-Crane the most useful tool around the mine. With interchangeable front end attachments, it can be used as a shovel, clamshell, dragline or crane to mechanize all your smaller jobs, anywhere, any time! There's no limit to the uses . . . and the savings.

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THEW **LORAIN**®

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CRANES
DRAGLINES
CLAMSHELLS
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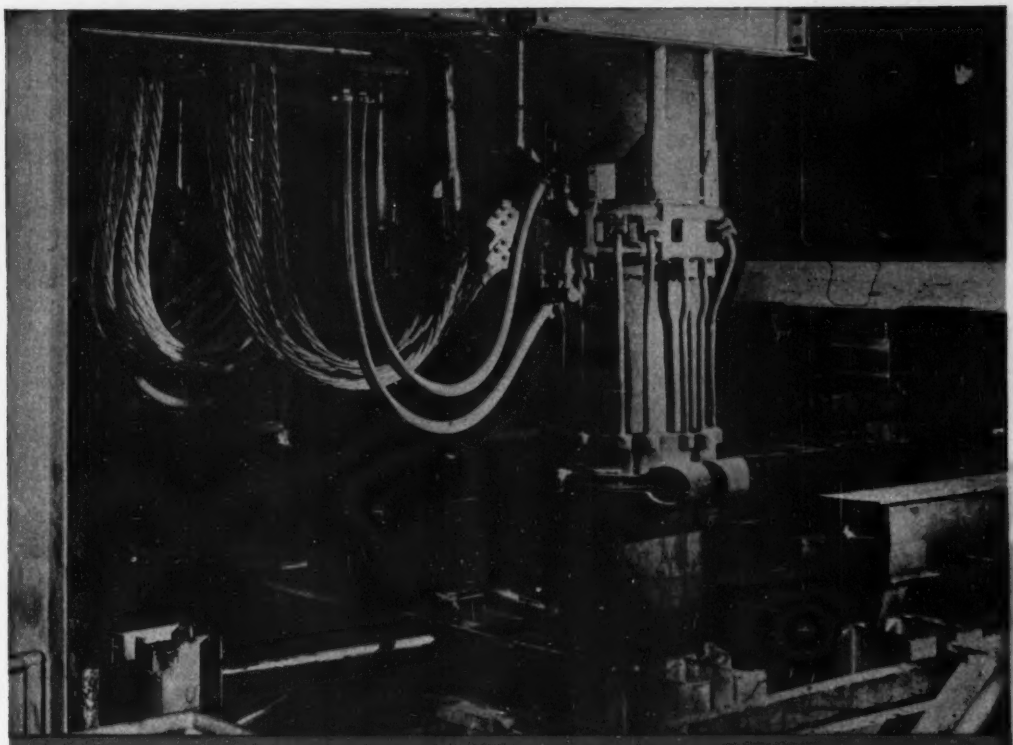

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with OXIDE REDUCTION engineered by LECTROMELT

Processing phosphate rock in a Lectromelt-designed arc furnace offers you a big advantage over the sulfuric acid method. With a Lectromelt* you can use a *poorer* grade of rock and get a *better* product, because the phosphorus is volatilized.

Savings like this are typical of the advantages of Lectromelt furnaces for reduction of all these oxides: iron, cobalt, nickel, tin, lead, beryllium, antimony, magnesium, arsenic and zirconium.

You can also use Lectromelt furnaces for selective reduction of ores not sufficiently high in desired metallic content for direct reduction. A low manganese ore, for example, with a manganese-iron ratio of less than 6 to 1, can be selectively reduced to that ratio. The reduction potentials allow the iron to be reduced from the ore, leaving a high manganese slag suitable for the manufacture of standard ferro-manganese.

Whatever your melting problems, chances are Lectromelt engineers have done the research that supplies the answers. We'll be glad to talk them over with you. Pittsburgh Lectromelt Furnace Corporation, 322 32nd Street, Pittsburgh 30, Pennsylvania.

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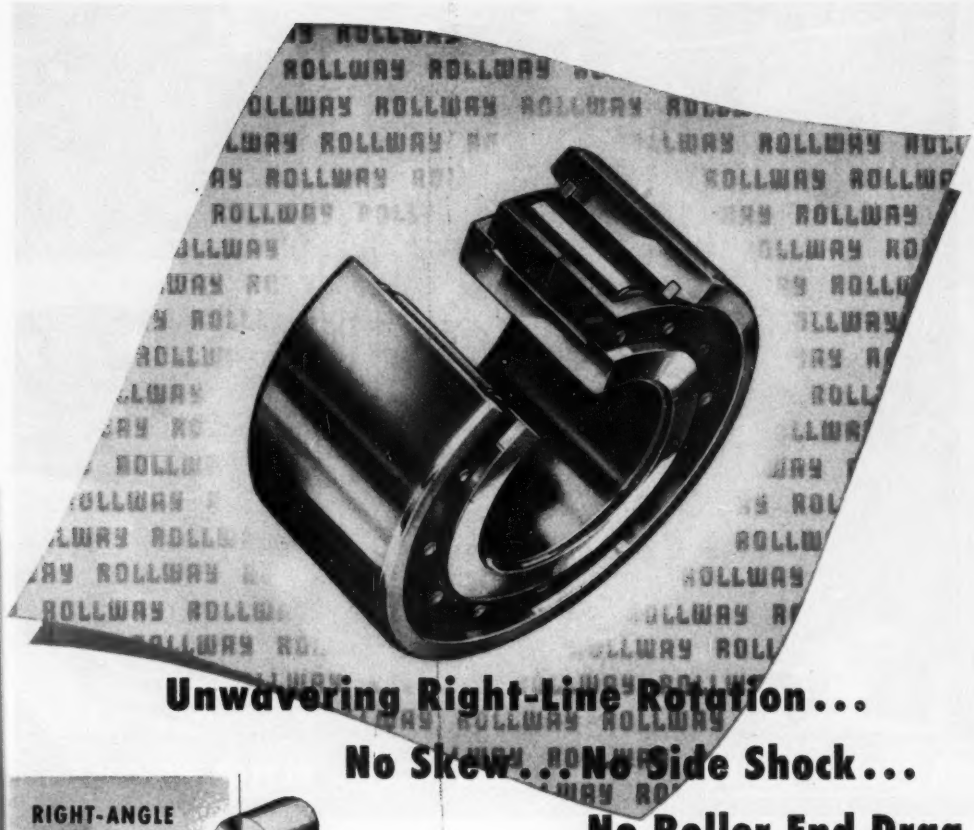
*REG. T. M. U. S. PAT. OFF.

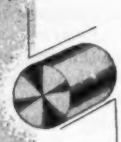
WHEN YOU MELT... MOORE RAPID *Lectromelt*



Unwavering Right-Line Rotation...
No Skew...No Side Shock...
No Roller End Drag

RIGHT-ANGLE ROLLER ENDS, precisely square to avoid end-rub, oscillation and side-shock.

RIGHT-ANGLE BEARING SURFACES with parallelism that results in unwavering rightline rolling.



RIGHT-ANGLE SEPARATOR SLOTS accurately machined to prevent roller skew, slide and uneven wear.

Test Rollway Maximum-Type Cylindrical Roller Bearings with your finest gauges. Notice that the bores are precisely cylindrical and that the surfaces of the separators are parallel to each other. The roller ends themselves are truly square on every diameter, and the bearing surfaces match the parallelism of both the separator slots and the roller races.

Line for line and surface for surface, each maximum-type Rollway Bearing is a beautiful piece of related precision and right-angle trueness. Each is precision-engineered for quieter running, lower friction losses and longer life-expectancy under specific conditions of maximum service.

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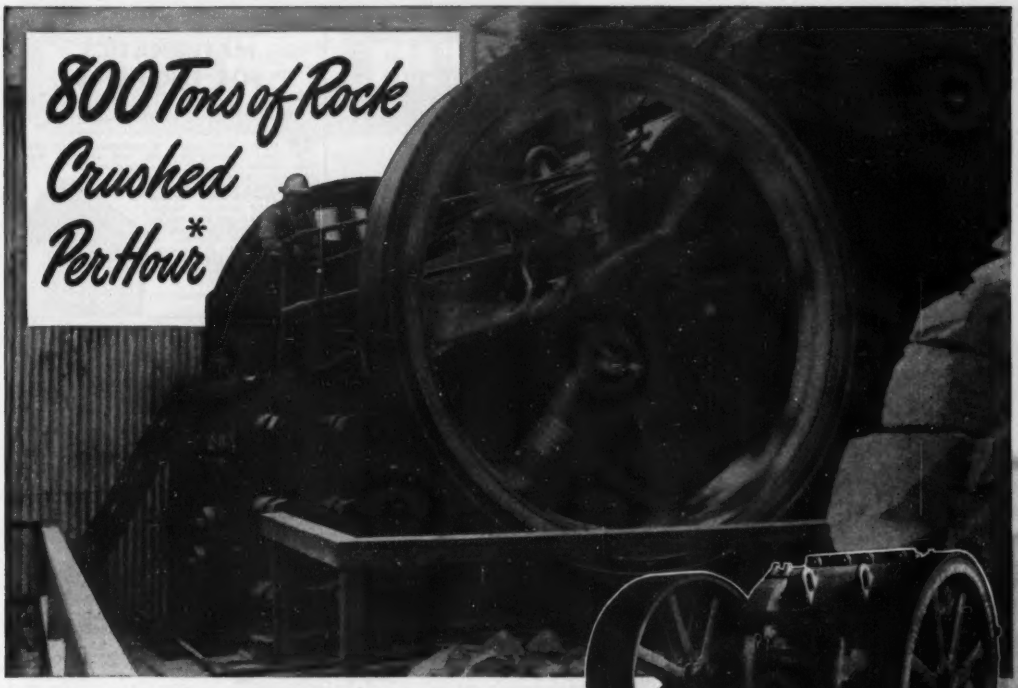

*..at Detroit Dam, Mill City, Ore.
by the

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PATENTED OFFSET TOE LUGS THAT NEVER WEAR OFF

installed on swing jaw and front head to double the life of jaw plates and cut maintenance costs in half.

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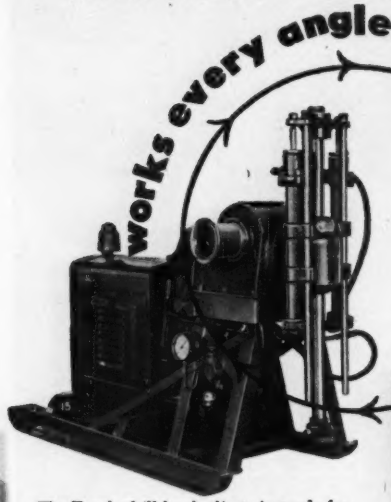
The NEW Acker Teredo Drill...



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The Teredo drill head adjusts instantly for drilling within a 360° radius. This combined with other Acker features such as built-in pumps, cargo-type winches, hydraulic or screw feed heads, choice of power plant, mounting on drag or any type of vehicle, are bound to save time, labor and on-the-job costs.

See for yourself—write for Bulletin 33-EM.

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LOOK AT THE BOX SCORE!

See Why the Swing is to *Life-Sealed* BALL BEARING IDLERS

	CONVENTIONAL TAPERED ROLLER BEARING IDLERS	LIPPMANN LIFE-SEALED BALL BEARING IDLER
BEARINGS	Tapered roller	Ball, like the rear axle on your car, takes thrust as well as radial load, absorbs punishment without service.
SHAFT	Through	Stub—saves cost, saves weight, requires less precise alignment.
LUBRICATION	Once a week with grease gun from one end—if grease congeals, bearing opposite fitting receives no grease.	Each bearing permanently lubricated and sealed. First LIFE-SEALED Idlers sold have been in continuous service for 7 years without added lubrication or replacement.
COST/IDLER (typical size)	$27.00	$24.00 — 15% less
COST/1000 FT. (4 ft. spacing)	$6750.00	$5750 — $1000 saved
WEIGHT/IDLER (same size)	58 lbs.	39 lbs. — 30% less
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INSTALLATION	Careful adjustment for running clearance with fine thread and castellated nut.	Brackets need not be precisely aligned—stub shaft has flexibility of a knuckle joint.
MAINTENANCE	Once-a-week greasing, periodic adjustment for wear. Must provide catwalk to grease and align idlers. Replacements cost more.	Lippmann builds conveyors without a catwalk (a saving of $5.00 per foot) because they need no lubrication, no adjustment for wear or distortion. 2004

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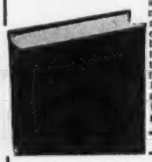

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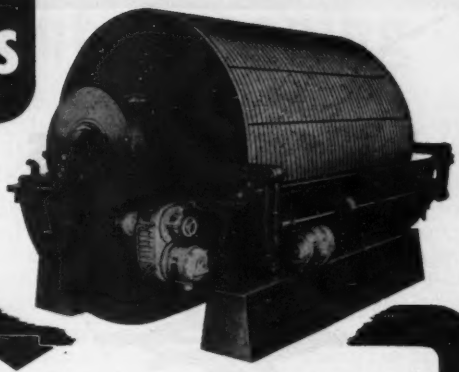

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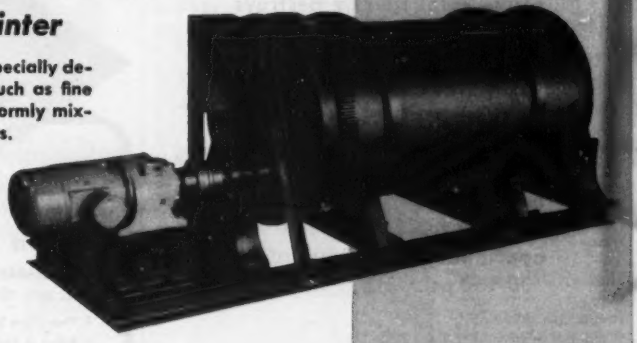

Shown at left is interior view of our SINTERITE Pelletizer Mixer in operation. Note the fluffing action, particularly suited to processing fine materials.

We invite your inquiries.

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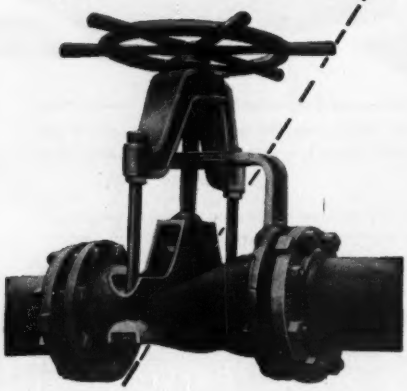

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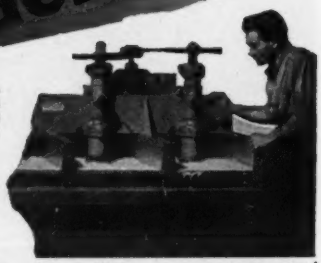

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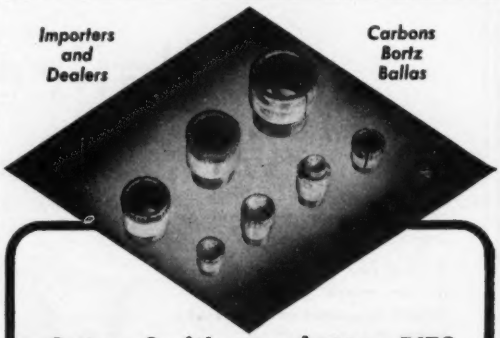

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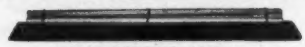
No. 8, size 2" x 2½" x 8" inside... 2.15 ea.



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For Tamping Explosive Shots: Poles are round, made of Hardwood. Sizes to 18' long. Price per lineal ft.: 1" dia. 8c; 1⅛" dia. 12c; 1¼" dia. 14c; 1⅜" dia. 16c; 1½" dia. 18c; 1⅝" dia. 26c; 2" dia. 32c. Special diameters and lengths can be furnished. These Poles meet the requirements of the New Federal Mine Safety Code.

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These poles are made of straight grained wood and are coupled together with removable wood pins held in place in recessed grooves by a rubber band and can be quickly connected and unconnected.
Couplers and Head Blocks are 4, 5 and 6 inches in diameter. Please specify size when ordering. Poles are 1½" in diameter.
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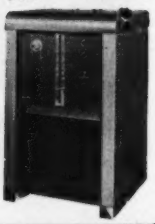

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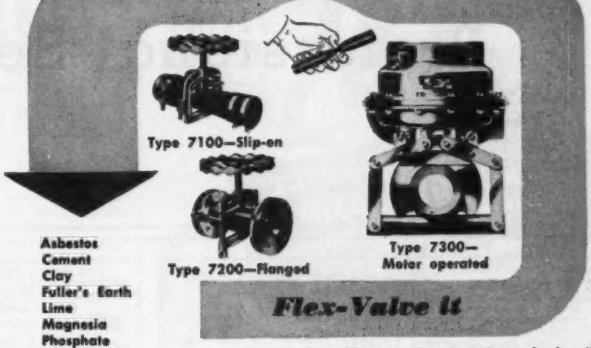

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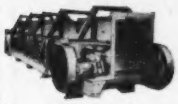

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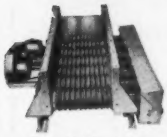

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1 Lot Industrial Steam Radiators.
1 Electric Panel Board, Marquette Electric.
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1 12" Nelson Flanged valve.
1 8" Nelson Flanged valve.
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10"	4	1/16"	1/32"	28 Oz.
12"	4	1/16"	1/32"	28 Oz.
14"	4	1/16"	1/32"	28 Oz.
16"	4	1/8"	1/32"	28 Oz.
18"	4	1/8"	1/32"	28 Oz.
20"	4	1/8"	1/32"	28 Oz.
20"	5	1/8"	1/32"	28 Oz.
24"	4	1/8"	1/32"	28 Oz.
24"	5	1/8"	1/32"	28 Oz.
26"	5	1/8"	1/32"	28 Oz.
30"	4	1/8"	1/16"	32 Oz.
30"	5	1/8"	1/16"	32 Oz.
30"	6	1/8"	1/16"	32 Oz.
36"	6	1/8"	1/16"	32 Oz.
42"	5	1/8"	1/16"	32 Oz.
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3—Dorr type H agitators for 22' dia. tank 14' high
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1—4' x 6' Morse drum filter
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1—4' single disc Oliver filter
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1—36" Merrill triangular filter press
1—#12 Sweetland 36 leaf filter press

BALL MILLS
2—3' x 2' Marcy ball mills
1—4' x 4' New standard ball mill
1—8' x 22' Hardinge conical pebble mill
1—5' x 4' Colo. Iron Works ball mill
1—64-½ Marcy ball mill

LOCOMOTIVES
1—1½ AM Mancha "Little Trammer" type B battery locomotive, 18-24" gauge.
1—2-2½ ton Whitcomb battery locomotive, 24" gauge
2—7 ton G.E. permissible type battery locomotive, 36 gauge
2— 8 ton G.E. battery locomotives, 36" gauge
4—10 ton Atlas battery locomotives, 36" gauge
1— 3 ton Whitcomb gas engine driven locomotives, 24" gauge
1— 3 ton Ruth gas engine driven locomotive, 18" gauge
1— 6 ton Goodman trolley locomotive, 36" gauge

TUGGER HOISTS
1—2 drum Ingersoll-Rand air tugger hoist, size KML-2G
1—Dillon-Box single drum air tugger hoist, model 3
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1—Ingersoll-Rand 2 drum electric slusher hoist, size 5NN-01-1
1—Sullivan single drum electric tugger hoist, class RH
1—Ingersoll-Rand single drum electric tugger hoist, size 107
1—Ingersoll-Rand 3 drum electric tugger hoist, model 10NNN2G
1—Sullivan 2 drum electric slusher hoist, model B-211
1—Ingersoll-Rand new 3 drum electric slusher hoist, size 20-MNM-20
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1—#20 Eimco rocker shovel loader
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1—3' x 5' Tyler "Hummer"
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2—10" x 36" Jeffrey new type ZA
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1—5" x 18" new Morse plunger ore feeder
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We have a hydraulic unit designed to do just that. It is capable of accelerating this mass from a 200 RPM threading speed to 7200 RPM in two seconds and decelerating back to 200 RPM in the same length of time. This unit was built as a pilot unit for experimental purposes, however still remains in the original crate as shipped to us by the manufacturer and except for trial runs, where it exceeded our requirements by several hundred RPM, it has not been used. Wire for full description, parts list and price.

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Excellent condition, 2 years old
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Mining Machinery, Equipment, T. Rail, Hoists, Headframe, Ore Bin, Pumps, Compressor, Diamond Drill, Rods, Ball Mill, Flotation Cells, Assay Supplies, Cable, Stopers, Drills, Etc.

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SQUIRREL CAGE MOTORS
3-Ph., 60-Cy.

Qu	HP	Make	Type	Volts	RPM
1	600	G.E.	IK	2200	514
1	600	G.E.	KT-412	2200	435
2	300	Whse.	CS-890	2300	1780
1	200	Whse.	CS-873C	2200	1160
1	200	ALCh.	AR	440/220	580
2	125	ALCh.	AR	2200	1750
1	125	Whse.	CS-761C	440/220	1750
1	125	C.W.	126-Q	440/220	430
2	100	Whse.	CS-643C	440/220	1750
1	100	G.E.	IK	440/220	1600
1	100	ALCh.	AR	2200	1160
1	100	ALCh.	AR	550	690
1	100	F.M.	H241B	440/220	435
1	100	Whse.	CS-938	2200	695
1	75	G.E.	I-K15	440/220	570
1	75	ALCh.	AR	2200	1765
1	75	ALCh.	AR	2200	1750
1	75	ALCh.	AR	2200	690
1	50	G.E.	KT	440/220	1160

SYNCHRONOUS MOTORS
3-Ph., 60-Cy.

Qu	HP	Make	PF	Volts	RPM
1	3000	Whse.	80	4800/2400	720
1	700	G.E.	80	2300	720
1	600	Whse.	80	2400	720
1	600	Whse.	80	440	600
1	300	Whse.	80	440	514
1	150	G.E.	100	2300	900
1	150	G.E.	100	550/2300	600
1	150	G.E.	80	550/2200	450
1	125	El.Mchy.	100	4800/2400	900
1	125	G.E.	80	2200	900
2	100	Whse.	80	440/220	1800
1	100	Whse.	80	2200	1200
1	100	Ideal	80	220/440	900
2	100	G.E.	80	220/440	600

SLIP RING MOTORS—CONSTANT DUTY—3-Ph., 60-Cy.

Qu	HP	Make	Type	Volts	R PM
1**	3000	G.E.	MT	2200	336
1**	1260	C.W.	SR	2200	327
1**	1000	ALCh.	ANY	2300	225
1**	600	G.E.	MT-39	2200	360
1	500	Whse.	C.W.	4600/2300	514
1	500	ALCh.	ANY	4000/2300	514
1**	400	ALCh.	ANY	2300	514
2	500	G.E.	I-16-M	2300	450
2	400	G.E.	MT-412	2200	450
1	300	G.E.	I-15-M	2200	1200
1	300	ALCh.	ANY	2200	514
1	250	G.E.	MT-416	2300	360
1	200	G.E.	I-16-M	2200	585
1	150	G.E.	I-13-M	2200	1750
1***	125	Whse.	CW-870	2200	870
1	100	F.M.	H20C	440/220	900
1	75	G.E.	IM	440/220	695
1	75	Whse.	CW-7540	440/220	690

** Mill type pedestal bearing. *** 3 bearing.

MOTOR GENERATOR SETS

Qu	KW	Make	RPM	Volts DC	Volts AC
1	2400 3U	Al.Ch.	720	525	4000/2400
1	1500	Whse.	514	250	4600/2300
1	1000	G.E.	514	575	4000/2300
1	500 3U	Whse.	1200	120/240	2300/440
2	500	C.W.	720	575	4000/2300
1	500	C.W.	720	250/275	4000/2300
1	300	C.W.	720	250/275	2300/440
1	200	Ridgway	900	250	2300
1	155	G.E.	720	250	2300/440
1	150	G.E.	1200	560	2300/440
1	100	Ridgway	1200	275	4000/2300
1	85	C.W.	1200	250	2300/440
1	75	Star	1200	230	440/220
1	75	Al.Ch.	900	250	2300
1	50	Burke	1800	240	440/220
1	30	Reliance	1800	250	440/220
1	25	Whse.	1200	120/240	440/220
1	20	Reliance	1800	230	440/220

(3U—3-unit set.)

TRANSFORMERS (Power)

Qu	KVA	Make	Type	Phase	Voltage
1	7500	G.E.	H	3	13000/29700-13800/13600
3	1500‡	Gregory	(X)	3	4160-480
3	350	Packard	OISC	1	13200-2300
3	150	G.E.	H	1	19000/9500-550/2300
3	100	Whse.	SS	1	13875/10955-330/440
3	100	G.E.	HT	1	13000-2400
3	50	Al.Ch.	OISC	1	22000-220
3	50	Wagner	HE	1	13200/11880-575/287
3	30	Penna	OISC	1	2400/4160-Y-120/240

(X) New, self-contained, indoor type, air cooled.

DIRECT CURRENT MOTORS

Qu	HP	Make	Type	RPM
1***	3000	Whse.	Encl.(Rev.)	600
1***	2400	Whse.	Encl.(Rev.)	600
1***	1500	Whse.	Encl.(Rev.)	600
1***	1200	Whse.	Encl.(Rev.)	600
1***	800	Whse.	Encl.(Rev.)	600
1	350	G.E.	CD-169	1150
1	325	Whse.	QM-650.6	450/900
1	200/250	El.Dy.	No. 22	400/1200
1***	300	G.E.	MPC	300/1200
1	300	Whse.	Mill	300/1200
1	300	Whse.		240/300
1	180	G.E.	MPC	600
2*	150	C.W.	83-H	800
1***	125	Whse.	SK-190	600
1	100/125	Rel.	1995-F	300/1200
2	100	Rel.	1050-T	400/1200
1	90/160	G.E.	MPC	635/1125
1*	50/75	Rel.	1995-F	300/1200
1	35	G.E.	RF-14	300/1500
1	35	G.E.	CD-123	400/1200
1	35	G.E.	CD-147	300/1200
1	35	Rel.	35P	250/1000
1	32½	Whse.	SK-150	400/1200
1*	30/75	Whse.	SK-151L	400/1200
1	30	Al.Ch.	E-145	400/1200
1	30	G.E.	CDM-105	875/1750
2	27½	El.Dy.	15S	450/1350
1	25	G.E.	RF-13	400/1600
1	25	G.E.	CD-123	400/1200
1	25	Whse.	SK-140	400/1200
1	25	Whse.	SK-111L	250/1000
3	20	Al.Ch.	E-030	400/1200
3	20	G.E.	CD-123	300/1200

All above 230VDC except where marked ***.
*** Pedestal bearing mill design 525/600-VDC.
(Rev.) Designed for mill reversing service.
* T.E.F.C.

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1—19 " "
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1—2020 New Holland
1—No. 4 Gates
1—15"x24" Blake
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1—8'x36" Hardinge Type
1—8'x22" Hardinge Type
1—5'x10' Cylindrical
1—54"x40" Sectionalized Cone
1—6'x6' Colorado
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1—Connor T-4 Air Driven
1—Connor T-8 Air Driven
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10—14 Cu. Ft. 18" Ga. Side or End Dump
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1—37 KVA w/Gas Engine
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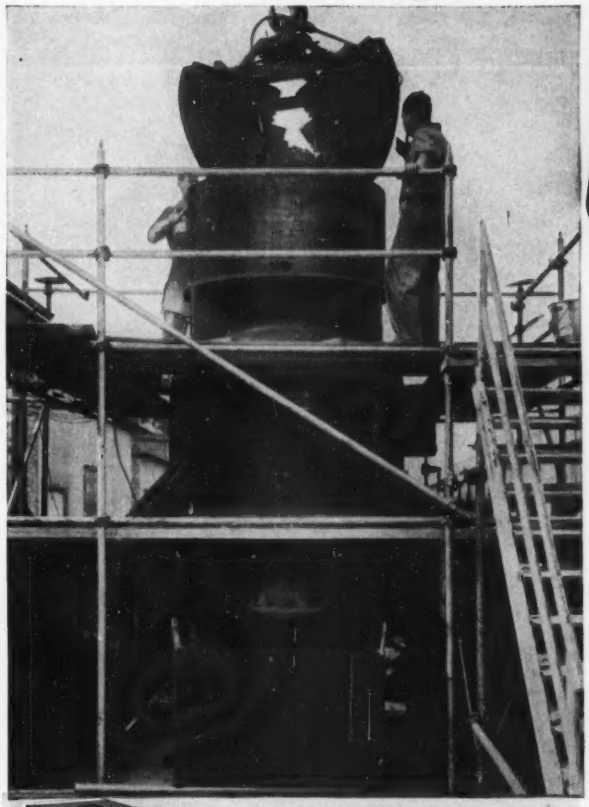
WILL YOUR CRUSHER MEET THIS Strength Test?



Oscillograph readings of strain on *Hydrocone* crusher were made at various points on the topshell spider, topshell, bottomshell and bottom plate. Test was made in A-C Processing Machinery laboratory by Allis-Chalmers engineers.

IN A SPECIAL TEST, the actual stress on various parts of a *Hydrocone* crusher was measured with an oscillograph. This stress analysis showed that strain on the crusher did not exceed 4000 psi at any point — even though hard taconite ore was being crushed.

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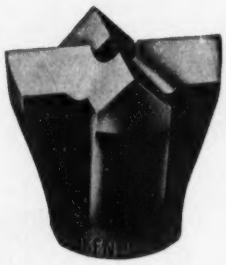

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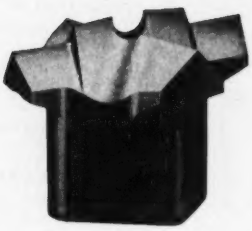
ROCK BIT



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